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LISTER PRIZE ESSAY.[1]

THE LIFE AND WORK OF LISTER.

By CHARLES C. W. JUDD,

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Carlyle once wrote that "Universal history, the history of what man has accomplished in this world, is at bottom the history of the great men who have worked here." These great men he calls "heroes," be they human or divine. In much the same way is the history of medicine composed. It is a history built up, like this world of ours, of the work contributed by its many heroes, whether real or legendary. Some few of these heroes are preëminent; they who have marked epochs in development, they whose work was essential to further progress, they who determined the various strata of medicine's history. Lister is one of these.

So much in the history of medicine is common educational knowledge that a hasty review of it must needs have grounds to justify such a procedure in presenting the life of one man. Lister's work, however, has such a profound bearing upon medical advancement that a clear idea of the rôle he plays in medical history warrants a brief account of those preëminent men on whose work he built.

Out of the mists of mythology in the history of medicine there emerges a first authenticated man, that gigantic Coän figure Hippocrates. Hippocrates was mortal, but his ancestry is shrouded in divinity and his training obscured by folk-lore. The famous oath of Hippocrates, sworn by his divine forebear Aesculapius[2] and Apollo, the god of the art of healing, makes these points none the less enigmatical. However that may be, Hippocrates furnished inspiration for a great branch of learning, a great field of accomplishment. He did his work well, he studied hard, he accomplished things. He healed the sick, he made keen and valuable clinical observations, some of which are still extant and living truths. He founded a great school of medical learning and gave us an ideal regimen of the physician's life.

Centuries later there stands forth a figure, also that of a Greek,[3] that dominated medicine from a period early in the Christian era until the Renaissance. This was Galen, who gave so much to the world of medicine, that for centuries that world insisted upon the unquestioned acceptance of his truth and untruth, who constructed (it is due to him to say unintentionally) a dogma as rigid, intolerant and inviolate, as that of any creed.

Galen's bulwark against advancement was, by some few,

[1] To the author was awarded the "Lister Prize," a sum of $150, offered by Dr. A. E. Malloch, of Hamilton, Ontario, Canada, according to the terms stated in the Johns Hopkins Hospital Bulletin, May, 1909.

[2] Identified with the Egyptian deity, I-em-Hetep, who was said to have lived as a healer of the sick as early as 4500 B. C.

[3] Most references state that Galen was a Roman. Though his birthplace, Pergamum, in Mysia, had been under Roman rule since 133 B. C., the spirit, tradition, language and customs of the place in Galen's time were all essentially Greek. References may be found in support of this in a "Classical Dictionary," by M. Smith —John Murray, London, 1863—under Mysia, Pergamum, Thrace, etc.; also a "Dictionary of Greek and Roman Geography," Ibid., 1878.

valiantly but uselessly attacked. Among the Moors, however, some progress was made, not by attacking Galen's weak points, but by establishing their own system of medicine. Under the "régime" dominated by Galen there arose factions among medical practitioners until there came to the front Ambroise Paré, who did much to break down these prejudices and to heal the schisms that had sprung up to rend the ranks of medicine. Even he could not, nor did he try to make headway against the authority of Galen. He did, however, place surgery upon a more rational basis than the world had ever known, thereby gaining for himself the title, "The father of surgery."

Then came the period of the Renaissance, the age of terrestrial and celestial discovery and the era of the Reformation. There was a great new birth of learning, when through the gift of printing, knowledge was disseminated throughout the old world. A great new world was found when adventurous sailors took ship for "westward-ho" and a great revelation made when a daring mind dissipated the "solar myth." Then occurred the third, but first successful, "uprising of the human intellect against the spiritual domination of Rome." Medicine too had a share in the great universal reaction, for just as there arose a Gutenberg, a Columbus, a Galileo, just as in the ranks of religious teaching, there sprang up a Luther to fight against the established belief as dictated by the Pope and champion a freedom of religious thought and work, so there arose in the ranks of medicine a champion, Vesalius, who first successfully questioned established tenets in medicine; who by demonstration and anatomical findings, refuted errors based on the prerogative of Galen. The work of Vesalius, however, out-Luthered Luther, for through the efforts of Loyola,[1] "who bore in the great Catholic reaction the same part which Luther did in the Protestant movement," the prestige of Rome to-day is supreme over a half of the Christian world, while Vesalius gave the death blow to the supremacy of medical authority and brought about the dawn of empirical methods, to which the science of medicine owes its establishment.

Stirring times these were after the lethargy of the Middle Ages, times when great things were discovered, when sound data were applied in a new way. The work of Vesalius in gross anatomy was continued by scores of earnest workers, who gave their time and energy to its cause.

The reform, however, did not confine itself to the subject of gross anatomy. From this time, the advances made in all branches of medical science are legion. Independent thought became possible, the demonstration of a fact by empirical methods rather than by traditional teachings was no longer scouted and the chains of superstition and dogma were broken. Under these conditions the true circulation of the blood was established, gross anatomy and pathology were refined through the use of the microscope, the function of the nervous system was approximated, physical diagnosis and clinical observations were amplified and other scarcely less important truths were established, while many an old and incorrect supposition was refuted.

It was not only the physician who added to our knowledge, but the physicist and chemist frequently gave the very "open sesame" when further progress was barred. For instance, the processes of digestion as understood to-day are based upon a host of valuable data determined in the schools of the famous German chemists, ably seconded by the French, English, Italian and Viennese investigators of the eighteenth and early nineteenth centuries. To the chemist Lavoisier we owe the explanation of the cycle of oxygen and an understanding of the basic principle of respiration. To Volta, the physicist, we owe the rectification of Galvani's erroneous idea of nerve stimulation. The three great weapons of the physician, the microscope, polariscope and spectroscope, are gratuities of the physicist. It is the long list of such "heroes," who, following in the wake of Vesalius, transformed medicine as an art into medicine as a science.

Contrasted with this splendid advancement in other branches of medical science, surgery was woefully deficient. Some new bits of operative procedure were developed, some unnecessarily severe polities were abandoned, but surgery, in spite of the ample opportunities the manifold wars afforded for practice, was scarcely better off than in the time of that godly Samaritan, Paré, who was wont to declare, "I dressed him and God healed him." The wars and the nations produced some gigantic operators, daring, ingenious, thoughtful men, but the necessity of inflicting severe pain and the inability to conquer in the unequal war against that arch enemy suppuration, were great odds against which they had to fight. The surgeon, indeed, needed the coöperation of Providence to effect a cure. The patient, indeed, needed the waters of Lethe and the gift of Morpheus combined to overcome the horrors of an operation and the pain of a long, offensive, debilitating recovery of healing by "second intention," interrupted appallingly often by an agonizing death from septicæmia, pyæmia, erysipelas, hospital gangrene or other form of acute suppuration.

At the close of the eighteenth century nitrous oxide was discovered and Sir Humphrey Davy called attention to the peculiar effects produced upon the psychical and nervous states when that gas was inhaled. He even went so far as to suggest it as a means of making operative procedures less painful, but the surgical world let slip this golden opportunity. It fell to the lot of America to introduce a general anæsthetic into surgical practice. Though both nitrous oxide and ether were used in isolated cases a few years earlier, the honor of disclosing the practical value of surgical anæsthesia must be awarded to Warren and Morton, who by the use of ether, in 1846, first gave a successful public demonstration in Boston, of painless operating. Within a year not only was this boon to surgery generally known and utilized, but chloroform was introduced by Simpson as a general anæsthetic. Here surgery began to be revolutionized. Extreme dexterity and rapidity in the operator had been demanded when each incision was an agony for the patient. But now more thorough methods, more delicate

[1] The contrast between Vesalius and Loyola is delightfully depicted by Foster in his "Lectures on the History of Physiology," on page 8.

technique and even simple exploratory operations could be resorted to.

The giant bugaboo of the surgeon, however, still persisted. The mortality, if not the suffering under the knife, remained unreduced, for suppuration swept on unchecked. Only veterans in surgery can give an accurate or even an approximate idea of the horrors that infection produced in the great hospitals and under the hands of the most skillful operators in the days before the introduction of antiseptic surgery. According to the older statisticians, as high as 80 per cent of the major surgical cases of the great hospitals died, not from the operation, but from subsequent infection, while healing by "first intention" constituted but a small portion of the remaining 20 per cent.

The centuries-long contention as to the spontaneity of the origin of life was quiescent in the early years of the past century. This pacific state of affairs was brought about by the investigations of Liebig, who had convinced the world that microorganisms owed their origin in some strange way to the oxygen of the air. For centuries there had been a theory that certain forms of life were causative agents of disease. Some of the surgeons, acting on these combined ideas, began to attack the problem of avoiding suppuration by excluding the air with its oxygen. We can readily understand how their methods failed, but those holding firmly to the belief, maintained that their technique and not their method was at fault.

The superb work of Pasteur on fermentation not only demonstrated the fallacy of Liebig's hypothesis, but explained the failures of those experimental surgeons who would reduce infection by hermetical procedures of operating. To the latter, Pasteur's was an iconoclastic doctrine. To surgery it seemed as though even that which it had, had been taken away. So it seemed until Lister turned the defeat into victory, for Lister it was who raised Pasteur from the position of a surgical iconoclast to that of an emancipator. Lister it was who saw that the processes of fermentation as determined by Pasteur had a direct bearing upon the phenomenon of the putrefaction of wounds. Lister it was who applied this inference to surgical treatment and he who revolutionized the whole of surgery, for it may fairly be said that "active surgery, the science of operating," emanated from this induction and the introduction of antisepsis.

The year of grace 1827 brought forth no great events in the history of England, but it was a significant one in the scholastic and domestic life of one sturdy Britisher, for in that year Joseph Jackson Lister, of Upton, Essex, made his first contribution to scientific literature and his wife, Isabella, gave birth to his son, Joseph. The Listers were of good citizen stock, belonging to that peaceable sect, the Society of Friends. Though a London wine merchant by trade, the elder Lister was of a scientific turn of mind and occupied his leisure hours with microscopic observations and improvements upon the mechanical structure of the microscope. In conjunction with Dr. T. Hodgkins, he first observed the formation of the red corpuscles of the blood into rouleaux and determined the diameter of the corpuscles by means of a camera lucida. As early as 1824 Mr. Lister began work on the acromatic microscope and it was at the suggestion and under the direction of Mr. Lister that Andrew Ross made his one-eighth inch objective. In Lister's contribution to the improvement of lenses, lies his chief claim to eminence in science, but it is no mean claim, for he transformed the compound microscope from a scientific toy which distorted as much as it magnified into a powerful engine of research. The younger Lister, in speaking of his father's work says: "Numerous improvements have since been introduced, both in this country and abroad, in the construction of the acromatic object-glass, but Lister's law of aplanic foci remains the guiding principle 'as the pillar and source' of all the microscopy of the age." Scientific thought, therefore, played a large part in the heredity and environment of the boy, Joseph, who first graced the home of the wine-merchant-microscopist on the fifth day of April, 1827.

The early home training of young Lister was carefully conducted. He was afforded the advantages of refinement, high respectability of living and every benefit short of over-indulgence. Of his advantages, not the least was the opportunity afforded him for a broad, thorough education. Though his early tutelage was intrusted to a Friends' school in Tottenham, one can well imagine that the father's interest in his hobby was extended to a careful introduction of his son to the microscope and some of the wonders it revealed, long before the younger Lister went to University College.[5] Subsequently, he went to the University of London,[6] where he graduated at the age of 20 with the degree of Bachelor of Arts. For the next five years he studied medicine under the Medical Faculty of University College and in the University College Hospital. Here it was, that by his studious habits, his intelligence and his genial personality, he gained not only the interest and esteem, but also the friendship, of his tutors and professors. Chief among those whose interest Lister aroused were Thomas Graham, who occupied the chair of chemistry, and Sharpey, that great teacher of physiology, whose influence over his pupils has ever been their delight and the wonder of those not so fortunate as to be counted among their number.

Lister's earliest researches, influenced doubtless by his father and Sharpey, were directed to the fields of histology and physiology. His first contribution, written in 1852, but not appearing until a year later, was upon the histology of the contractile tissues of the iris. In this paper he verified Koelliker's previous observations upon the identity of that tissue with non-striated muscle. On June 1, of the same year, another manuscript dealing with the muscular tissue of the skin was given publication. Still later that year appeared his observations on "The Flow of Lacteal Fluid in the Mesentery of the Mouse." This was not in itself particularly important. It did show, however, his accuracy of observation and his determination to see things with his own eyes. The thoroughness with which each subject dealt with was treated, the untir-

[5] Macaulay is responsible for a delightful defense of this institution and a description of the environment it afforded.

[6] University College was not, until many years later, incorporated in the University of London.

ing energy with which each investigation was pursued from its undertaking to its completion, induce one to believe that the words of his future friend, John Brown, were inspired by Lister's own example: "You come to the chest of knowledge. It is shut, it is locked, but . . . . you have the key, put it in steadily and home. But what is the key? It is the love of truth; neither more nor less; no other key opens it; no false one, however cunning, can pick that lock; no assault of hammer, however stout, can force it open, but with its own key, a little child may open it, often does open it, it goes so smoothly so with a will." It was with this key that Lister attacked each problem.

This series of experiments and the careful reports he published describing them, placed Lister in the field of original investigators. It is not, however, to be concluded that he devoted his time exclusively to laboratory research. On the contrary, his most active work was in the hospital, for he served as dresser to, and later as successor to Henry Thompson, as house surgeon, under Mr. (afterwards Sir) J. E. Erichsen.

Upon leaving University College Hospital in 1854, Lister, heeding the advice of Sharpey to "take six weeks of Syme's clinic," went to Edinburgh and started work under that kindly Christian gentleman and famous surgeon, who was considered "the safest operator of his day." These six weeks grew into as many years, the first two spent as acting resident surgeon to Syme, and the remainder as assistant surgeon in the Royal Infirmary, Edinburgh.

It is a fair presumption that it was not only Syme's clinic that prolonged Lister's residence there, but that Syme's daughter played no small part in making his sojourn a question of years. In any case we learn that Lister's share in the social coterie of Syme's assistants, famous pupils and cultured friends was not the least, and that he was not long in winning his teacher's daughter, Agnes, as his wife.

These were happy years in Edinburgh, happy in the intimacy they gave him with the frequenters of Syme's hospitable household, of which Lister was for a time an inmate, happy in the companionship of the great master himself and happy too in work well performed. Dr. John Brown, the Holmes of Scotland,[7] we know well as one of the number of frequenters of Syme's household. Brown's friends (including Sir Walter Scott, Lord Erskine, as well as "Wee Marjorie Fleming" and a host of others) his kindness, his refinement, his culture and his genius, give the cue to the delights this house afforded. In his "Marjorie Fleming"[8] will be found a sketch from which one can picture what Lister's social and domestic life must have been, while in "Rab and His Friends"[9] one has an indelible glimpse of Syme as a man and as a surgeon. This same little story of "Rab" also depicts the prevalent tragedy in surgery in the days before either anæsthesia or antisepsis came as priceless gifts to surgeon and patient. John Brown was not alone though, for many a "Savant" had a share in the Syme's entertaining. Famous surgeons from all parts of the kingdom and from the continent made Syme's clinic their Mecca and found their way most readily to share in his open hospitality. Men of letters and diplomats were no less welcome. Here it was that Lister became associated with many of the distinguished men of the day.

The relation between Syme and Lister was not merely that of master and pupil, nor was it confined to the still more intimate family connection established by Lister's marriage. There was always the highest esteem in the mind of each for the integrity of soul and surgical ability of the other. Syme never tired of speaking in the highest terms of Lister's ability and in prophesying a great future for him through his application of science in general to his profession, while in procedures of operating, Lister invariably gave the credit to the training he received under the intrepid Scotch surgeon.[10] We learn too that in the operating room, "he (Lister) did some brilliant and daring work with Syme."

However exacting Lister's work may have been in the wards and surgery, he made time for other activities. It was in Edinburgh that Lister began his career as a teacher, holding the position of extra-mural lecturer on surgery. Annandale, one of his pupils during this time, states, that from the very beginning his many original and interesting suggestions in connection with histology and surgical pathology made his course popular with the most diligent and capable students and that, moreover, these suggestions, looked back upon from the present state of knowledge, were the forerunners of the important investigations leading up to the introduction of those great antiseptic principles which have revolutionized surgical practice.

Into original investigation Lister threw himself with his accustomed energy and painstaking care, for combined with his love of truth he possessed the traits of patience, persistence and sustained concentrated attention in the working out of details. Illustrative of this, it may be noted that he followed up his earlier investigations on the histology of non-striated muscular tissue by a report before the Royal Society in 1857 "On the Minute Structure of Involuntary Muscular Fibre." Another instance of this habit of mind may be found in the fact that his previous study of the viscera[11] led him to make further investigation into the physiological functions of certain visceral nerves. This, in turn, stimulated inquiry upon nerve-trunk morphology. An isolated study, which deals with the "Cutaneous Pigmentary System of the Frog," remains to-day

[7] Some six or eight weeks after the association of these two personalities occurred to the author, an editorial in the August 28, 1909 edition of the Journal of the American Medical Association, drew a similar comparison between the two men.

[8] Spare Hours, by John Brown, M. D., second series, pages 51-80, Houghton, Mifflin & Co., Boston, 1884.

[9] Spare Hours, by John Brown, M. D., first series, pages 393-413, Houghton, Mifflin & Co., Boston, 1884.

[10] Syme's influence upon Lister is beautifully illustrated by a comparison of the former's "Excision of Diseased Joints" (1831) and Lister's great surgical paper, "Excision of the Wrist for Caries" (1865).

[11] "Observations on the Flow of Lacteal Fluid in the Mesentery of the Mouse."

one of the few important contributions to the subject. In pathology he began the study of the early stages of inflammation, which though not so extensive, or complete as the entire theory as later promulgated by Cohnheim, yet conforms closely to many of the observations made by that pioneer in the modern conception of the phenomenon. It was in this period too that Lister began his researches upon coagulation. The first challenge of Richardson's theory, that the coagulation of the blood was due to the liberation of ammonia, was made by Lister as early as 1858, when he determined that coagulation in the blood-vessels was due to injury to them and not a dissociation of ammonia from the blood. Conversely he showed that the integrity of the vessels was the means whereby the blood was normally free from coagulation while in circulation and that this condition was not due to the blood's combination with ammonia.

Made professor of surgery in the University of Glasgow in 1860, Lister went to that city and the following year was also elected as a surgeon to the Glasgow Royal Infirmary. He and his students in the University continued his previous investigations on the coagulation of the blood. Lister applied himself to the development of this problem with the assiduous care, faultless logic and keen observation so characteristic of all his research work. To this end he devised elaborate experiments, an account of the results of which culminated in the address delivered as the Croonian Lecture of 1863. This was the *nimesis* of the accepted ammonia theory of coagulation. Moreover, it enunciated the idea that foreign substances hasten the action of coagulation. "The lucidity and logical power in the conduction of his many ingenious and delicate experiments to overthrow this well-established theory entitles Lister to no small station among the English physiologists who have from the beginning been leaders in the phenomenon of blood coagulation." This comment, appearing in a contemporary number of the "Lancet," is a very just estimate of this work. This much may be said in the present state of our knowledge, about the influence of the first great product of Lister's genius: that it set at naught an erroneous though well-established theory on the phenomenon of coagulation and described accurately many details of that phenomenon upon which the prevailing opinion of the process is based.

The study of wound-dressing is still a question of vital interest to surgeons, while its development constitutes one of the most fascinating fields in surgical annals. It was Lister's part in this development that has placed his name among the immortals of medical history. While in Glasgow, particularly, Lister was impressed with the frightful prevalence of suppuration in wounds and its consequences. "In contrast to his associates, he manifested a profound discontent with things as they were." The frequent occurrence of infection in compound fracture, and its absence in simple fracture, was an observation that struck keenly the discriminating mind of Lister. Basing his opinion upon his previous investigations, Lister believed that the primary cause of such suppuration in compound fracture and in wounds in general was the decomposition of the blood and serum they contained, brought about by some gaseous constituent of the air. On empirical grounds he insisted on scrupulous cleanliness on the part of his dressers and himself in all his surgical work, using ofttimes deodorant solutions. His wards, however, seemed little if any better for this precaution in the avoidance of infection.

Lister deserves no great credit for the employment in this manner of deodorant lotions; the policy had precedent, since for many decades and even centuries, substances now known to possess decidedly antiseptic properties had been known and used as cleansing lotions in medical practice, in the same way that Lister used his deodorant lotion, certainly with little effectiveness and with no more sound basis of reason. Astonishing guesses at both antisepsis and asepsis are numerous in the archives of surgical literature, but the fact that they were mere conjectures, and not rational deductions, has lost them their place. A single example will suffice to account for their failure to gain recognition. It is told of Coldbatch that he used a paste composed of boracic or salicylic acid for local application to wounds, but as a solvent he used indifferently water or urine! Of those who more wisely surmised probably none is entitled to so much consideration as Semmelweis, who, though no more guilty of a knowledge of the microbic origin of septic poison than our prehistoric forebears, though ignorant of any application of his method to surgery, still used in his obstetrical practice a strong antiseptic lotion for cleansing his hands as a prophylactic measure against puerperal contagion. When, however, this forgotten method, used as early as 1847, was brought to Lister's attention in 1883, he thenceforth regarded Semmelweis, whose work had been repudiated by the profession, as in some measure his forerunner.[12]

While Semmelweis was sinking into oblivion, a young scientist of France was coming to the front. The connection between the work of this scientist, Pasteur, and Lister is too close to permit of any satisfactory account of one without something more than passing reference to the other. Primarily a chemist and physicist, but scarcely less a biologist, Pasteur had already laid the foundation on which Emil Fischer later built his extraordinary structure on the constitution of the sugars. This foundation was the determination of the phenomenon of physical isomerism and the introduction of stereo-chemistry, based upon the classical investigation into the crystallography of tartaric acids. Commercialism immediately made use of Pasteur for a certain alcohol manufacturer, M. Bigo, experiencing difficulty in his fermentation, employed Pasteur to determine the cause of the "oxygen"

[12] Dr. Theodore Duka, a Hungarian physician, after bringing the claims of Semmelweis to Lister's attention, wrote a small monograph, in 1888, entitled, "Child-bed Fever, Its Cause and Prevention—A Life History" (of Semmelweis). This was published in 1892 by Austin & Sons, Hertford. Last year, a more extensive biography, by Wm. J. Sinclair, published at the University Press, Manchester, appeared (reviewed by the Journal of the American Medical Association, Vol. 53, page 2032). Though both extol the greatness of Semmelweis, they fail to show that he did more than wisely surmise what Holmes surmised and brought before the profession, and what Lister did not guess—but proved beyond peradventure.

being deficient in his vats. Brewers and alcohol manufacturers, as well as scientists, imbued as they were with the doctrine of Liebig, thought that fermentation was a chemical and not a vital change. So Bigo employed Pasteur. Well for Bigo, well for the world at large that he selected the right man! It was the result of the pursuit of this problem that Pasteur gave the world the knowledge that fermentation is due to microbic contamination and the sentence "La génération spontanée est une chimère." The subsequent work of Lister, which was actuated by this discovery, undoubtedly had a marked effect upon Pasteur's later investigations. These resulted, in 1880, in the first isolation of the causative agent of an infection and its attenuation in virulence for purposes of inoculation in the production of an immunity. It may justly be said that Lister would never have conceived his idea of antisepsis without Pasteur. On the other hand, Pasteur, without Lister's work, may well have overlooked the application of his discovery as a factor in the etiology of disease, along which line his entire attention was directed thenceforward to the inestimable benefit of the industrial arts and medicine.

The advent of Pasteur's work on fermentation, coming as it did at a time when suppuration and its consequences was a theme so near to Lister's heart, was immediately coupled in his mind with an observation made in Carlisle in 1864, where carbolic acid was used as a deodorizer in the sewage. It chanced that certain cows pastured there were freed from protozoa, which up to that time had infested them. Lister's thought was, to quote from a paper read by him years later: "If the wound could be treated with some substance which without doing serious mischief to the human tissues, would kill the microbes already contained in it, and prevent the further access of others in the living state, putrefaction might be prevented however freely the air with its oxygen might enter." Carbolic acid appeared best suited to serve this purpose. His first application of this idea, in 1865, was tried in the treatment of compound fracture. His first case was a failure, but further attempts with more elaborate precautions justified his theory. His method was to wash out the wound with undiluted carbolic acid, which with the coagula made a paste. This was allowed to remain in the sore. Well overlapping the area of injury, he applied a dressing saturated with carbolic acid which was kept in place and adherent to the limb by a piece of block-tin. Over this were applied the splints and bandages. Each day, until deep healing was obtained, this dressing was renewed. In the later stages, to avoid undue irritation from the antiseptic, other dressings less irritant were applied. The result of this method led to healing as uninterrupted as in the case of simple fracture. With these results as a basis to justify his procedure, in August, 1867, Lister promulgated his fundamental idea in an address at Dublin, before the British Medical Association: "In the course of an extended investigation into the nature of inflammation and into the healthy and morbid condition of the blood in relation to it, I arrived several years ago at the conclusion that the essential cause of suppuration in wounds was decomposition, brought about by the action of the atmosphere upon the blood or serum retained within them, and in the case of contused wounds, upon portions of the tissue destroyed by the violence of the injury. To prevent the occurrence of suppuration, with all its attendant risks, was an object manifestly desirable, but till lately apparently unattainable, since it seemed hopeless to exclude oxygen, which was universally regarded as the agent by which putrefaction was effected. But when it was shown by the researches of Pasteur that the septic properties of the atmosphere depend not upon oxygen or any gaseous constituents, but upon minute organisms suspended in it, which owed their energy to their vitality, it occurred to me that decomposition in the injured parts might be avoided without excluding the air by applying as a dressing some material capable of destroying the floating particles."

This paper gave rise to an avalanche of criticism—criticism of incredulity—as to the efficacy of the method and criticism of non-priority in the use of phenol for this purpose. Through his application of the sciences to his work, Lister was so far ahead of his own day that such censure is not surprising. Even at the time when he went to London many years later, opposition to "innovations" was so strong in examining boards there, that the younger students, those who would have served best in giving impetus to the new method, were skeptical and afraid to adopt and defend "Listerism." Again the tentative use in surgery of chemicals with antiseptic properties by such men as Bassi, Semmelweis, Lemaire, Bottini and others, before Lister's advocacy of carbolic acid, gave some ground for the claim of non-priority. Even so distinguished a surgeon as Sir James Y. Simpson[13] (no other than he who introduced acupressure as a hæmostatic agent and chloroform as a general anæsthetic) bitterly attacked Lister upon these grounds. His error lay in this: that he failed to discriminate between a mere surgical dressing and a basal principle underlying a whole surgical system, between bland empiricism and strict scientific deduction.

Quite the antipode of Pasteur, who vehemently defended each questioned hypothesis which he propounded, Lister was always dignified in the espousal of the great truth he offered the world. A few months after his Dublin address he thus defended his discovery, clearly defining his claim to priority as being based, not upon the use of phenol, but upon the theory of antisepsis: "I may repeat that I never claimed to be the first to use carbolic acid in surgery. The success which has attended its employment here depends not so much on any specific virtue in it, as on the wonderful power of recovery possessed by injured parts when efficiently protected against the pernicious influence of decomposition. I selected carbolic acid as the most powerful of known antiseptics; but I think it not unlikely that my object might have been gained by using on the same principle some familiar disinfectant." He further stated that it was not to be expected that carbolic acid would act as a charm, but that whether this agent or some other of analogous properties was employed, it was only by the

[13] Simpson's was a pugnacious spirit. Vide, "Sir James Y. Simpson," by Dr. L. Gordon, in "Masters of Medicine Series," New York, Longmans, Green & Co., 1898.

light of sound pathology and strict attention to practical details that the full measure of magnificent results which the antiseptic treatment was capable of affording could be attained.

Far more potent than words coming from the pen of Lister, however, were the works of the great man in establishing his sound principle upon a firm basis. Henceforth his object was to demonstrate the logic of his conclusions, to show that these conclusions were invaluable to the science of operating and to simplify his technical method of excluding contamination to such an extent that there might be a minimum of irritation to the tissues consistent with absolute safety against suppuration. Having satisfied himself as to the reliability of his treatment of compound fracture, he next turned his attention to the treatment of large abscesses. His method was to incise with antiseptic precautions, cleanse and apply a putty of phenol, linseed oil and carbonate of lime—a compound devised by himself to take the place of the natural putty formed of phenol and coagula. This technique yielded brilliant results and promoted rapid healing without constitutional disturbances.

The astute observations of the pathological phenomenon of healing in these wounds led Lister to his next innovation.[1] He observed that under antiseptic conditions, injured tissues of a wound, instead of sloughing served as a pabulum in the process of repair, were later absorbed and finally supplanted by living tissue. Even dead bone was seen to be thus replaced by healthy osseous material. Absorbable substances had been used as ligatures decades before, but owing to their causing suppuration, which led to secondary hemorrhage, their employment had been summarily discarded. Lister was convinced that these failures were due to the septic condition of the material used for ligation. By a process of "philosophical induction" from his observations on antiseptic repair, he concluded that a material of animal matter, strong, soft, pliable and free from contamination would form a successful ligature. For this purpose he employed prepared cat-gut. Careful experiments were devised by him to treat this in such a manner as to free it from contagion and still retain its physical characteristics. Its disadvantages were that the sterilizing process required considerable time to complete and the ligatures would occasionally undergo too rapid absorption. To obviate this delay and control the lysis, many years later he devised an improved method, where, by chromatizing his material he obtained especially good results without loss of time and without increasing the chance of inducing sepsis or hemorrhage. Even with the first method of preparation, animal experimentation convinced him of the efficiency of this substance as an absorbable ligature. In the application of it to surgical practice he observed that the ligatures about the vessels became absorbed and replaced by a ring of living tissue, that this procedure obviated the use of long threads and did not require removal with its attendant pain to the patient and danger from hemorrhage. To this conception and these experiments are due a simple measure which is still frequently and efficaciously employed in surgical routine.

The development of asepsis from antisepsis as promulgated by Lister has been and still remains a field of rather bitter controversy. Some few strenuously maintain that to Lister belongs none of the credit of aseptic surgery. The vast majority, however, see in asepsis but a development, a natural evolution of Lister's antiseptic management of wounds. Surely antisepsis, in its wider sense, embraces asepsis. The latter is applicable only to some injuries inflicted by the surgeon, the former alone is adequate in the surgical treatment of accidental trauma, while both have as their underlying principle the exclusion of pathogenic bacteria from open wounds. With these details in view, any controversy as to the origin of either system would indicate that the pendulum of condemnation has swung beyond the point of wisdom, that the zeal for asepsis, like most reactions, has gone too far. Convinced of this, Championnière states that "aseptic surgery is as much an issue of the discovery of Lister as is true antiseptic surgery." To establish a contiguity between asepsis and antisepsis would undoubtedly give added support to this statement. In some measure there is a connecting link in the prophylactic treatment of infection by the increasing employment of such agents as hexamethylenamine in both medicine and surgery, silver compounds in the ophthalmic treatment of the new-born and the like.

The evolution of asepsis from antisepsis, moreover, was forwarded in large measure by Lister himself. Therein lies the greatest claim to the soundness of Championnière's statement. It was during Lister's residence in Glasgow that he called attention to the "aseptic" condition of wounds after antiseptic treatment and emphasized this condition as the one striven for. From this early date he believed that an antiseptic was injurious to the cellular elements of the body as well as to the microorganisms and that the aim of the surgeon should be in its employment in sufficient but not in excessive amounts. To this end he began measures for the reduction of the inflammation caused by the application of antiseptics and instituted investigations into the pharmacological action of the drugs used for this purpose. He commenced decreasing the concentration of solutions used. He also introduced a protective plaster of prepared oiled silk rendered aseptic by the use of antiseptics. This he applied next to the wound, over which the active antiseptic plaster was spread. As the result of this investigation into the action of phenol, he first formulated the now well-known pharmaceutical law that "the energy of action of any substance upon the human tissues depends not only on the proportions in which it is contained in the material used, but also upon the degree of tenacity with which it is held by its solvent." This property he utilized by combining phenol with an organic vehicle. The antiseptic was thus rendered less irritating to the tissues, because in this combination the phenol was liberated slowly and yet the energy of action was sufficient to form an effectual bulwark against the invasion of bacteria. This account affords

[1] Vide "On Some Points in the History of Antiseptic Surgery," Vol. 2, page 395, "The Collected Papers of Joseph, Baron Lister." This whole letter is most valuable in displaying the early evolution of antiseptic treatment as it occurred to Lister's mind.

an outline only of the innumerable improvements made by Lister over his earlier method, all of which had the one object; to simulate as far as possible in his treatment of open wounds, the conditions existing in simple fractures. His conscious aim was asepsis. His approaches to it in practice, however, were gradual, as he was loath to adopt any method which he considered had in it any element inconsistent with absolute safety. In 1890, in speaking of this aspect, he states: "I have not ventured to make the experiment (asepsis) on any large scale, though I have long had it in contemplation. It is a serious thing to experiment on the lives of our fellow men, but I believe that the time has now arrived when it may be tried, and if it should succeed, then perhaps would be fulfilled my early dream. Judging from the analogy of subcutaneous injuries, I hoped that a wound made under antiseptic precautions might be forthwith closed completely, with the line of union perhaps sealed hermetically with some antiseptic varnish, and bitter was my disappointment at finding that carbolic acid induced by its irritation such a copious effusion as to necessitate an opening for its exit; hence came the drainage of wounds. But if we can decrease the use of an antiseptic substituting aseptic and non-irritating materials in the operation, we may fairly hope that the original ideal may be more or less attained."

Lister left Glasgow in 1869 to assume the chair of clinical surgery at the University of Edinburgh made vacant by Syme's retirement from active work. Syme died the following year. In spite of his appreciation of Lister's genius and his advocacy of the younger surgeon's methods, the principle of antiseptic treatment was practically unknown to the students at the University. Lister sought to teach them by means of the observation of phenomena, to appreciate not only the value of his doctrine and discoveries, but also, as he says, using John Brown's phrase, "the value of the love of truth."[18]

To rest upon his discovery was not Lister's method. To perfect what he had already accomplished, to observe and to explain his observations, to get at the very underlying principles governing his doctrine; these were the results at which he aimed. To this work he brought a capacity for the practical application of all means at his hand which would accomplish his ends. An example of this adaptability was his introduction of the "carbolic spray" to sterilize the air about the field of operation. This mechanism he perfected from time to time, finally employing steam to effect the atomization of a dilute solution of phenol, which was thus diffused throughout the atmosphere, rendering, as he thought, the operating room sterile. This was not finally discarded by him as being unnecessary until 1887, though six years before he began to doubt the need of this precaution. It is not to be denied, indeed it should be insisted upon by those who wish to have Lister's work given a just valuation, that in the early days he labored under the misapprehension that air was the chief medium through which poison was brought to wounds, though he recognized then and with ever-increasing conviction that all foreign materials, ligatures, instruments, skin, clothing, etc., were contagion carriers. Finally he expressed himself thus: "I was led to conclude that it was the grosser forms of septic mischief rather than microbes in the attenuated form in which they existed in the atmosphere that we had to dread in surgical practice." Lister's unnecessary prudence with reference to atmospheric infection, like his hesitation in abandoning the use of antiseptics for asepsis, is indicative of his elaborate precautions against the access of microbic contamination. Granting that they were both errors, still they were on the right side and illustrate Lister's fundamental principle in the treatment of his cases: "Let the thing tried be that which, according to our best judgment, is the most likely to promote the welfare of the patient."

The investigations pursued by Lister during his second residence in Edinburgh into the bacteriological and chemical nature of various antiseptics is of importance. Carbolic acid had been found satisfactory in that it was efficient, but it produced an undesirable irritation. Boracic acid having found favor with some surgeons, Lister subjected it to a searching study. He determined that even concentrated solutions were not always reliable. On boiling, however, he found that a considerably greater degree of concentration could be obtained and that gauze impregnated with this hypertonic solution made an efficient dressing for infected wounds without causing undue irritation. Carbolic gauze, salicylic acid, zinc chloride and other chemicals were likewise given a thorough investigation to determine their relative antiseptic properties. Though not intolerant in any degree of other antiseptics, Lister, in the light of his own researches, remained faithful to phenol, until finally, in London, by his ingeniously devised methods of standardizing the bactericidal properties of chemicals, he adopted mercury compounds as being the most efficient in non-irritating concentrations. Of these he used the bichloride first, though later he advocated the double cyanide of mercury and zinc.

Lister's surgical cases in Edinburgh afforded a significant phenomenon which did not escape his observation. He noted that any darkening of the protective plaster used in his dressing of wounds was, when accompanied by odor, an indication of sepsis. But two anomalies were also noticed, namely, that sometimes this evidence of sepsis occurred without local or constitutional disturbances, and on the other hand, that local and constitutional disturbances sometimes appeared without attendant darkening of the dressing. How could this be explained? At that time fermentation and suppuration were not known to be distinct phenomena. Specific bacteria were not recognized as causative agents in the various forms of suppuration. The ignorance existing concerning these two facts is not in the least surprising, seeing that the science of bacteriology was but in embryo. In spite of this lack of established data, Lister suggested that the various forms of putrefaction, pyæmia, gangrene, etc., and even modifications of these troubles might well be due to different orders of micro-

[18] Osler, in the Harveian lecture, 1906, states that Lister is one largely instrumental in "The Growth of Truth."

organisms, thus more than hinting at what are now known as "mixed" infections.

Through the application of his methods the conditions in surgical hospitals were completely changed. Several lectures on the salubrity of those institutions where his methods had been adopted, pointing out their transformation from hot-beds of pestilence to "models of healthiness," gave great impetus to the propagation of the new truth on the continent. The brilliant work of his pupils abroad must not, however, be overlooked in this connection. Saxtorph and Bloch, in Denmark, and Championnière, in France, had already made their influence felt in the diffusion of Lister's doctrine. During the Franco-Prussian War, Lister wrote a pertinent paper on the application of his tenet to military surgery, but the authorities in Germany were somewhat dilatory in its application. Thiersch, Volkmann, von Miculicz and other pupils of Lister, however, soon made their impression upon surgical thought and practice.[16] When Lister made a tour on the continent in 1875, his progress was marked by an almost triumphal procession. In Leipzig and Munich great festivals marked the occasion of his presence. Clinics were held by von Langenbeck, Thiersch, Volkmann and others to demonstrate the success of the master's genius. He was hailed as a "savant" and benefactor. In all those hospitals where antiseptic measures had been adopted, he found the pest of suppuration a stranger. On the continent the achievements of his genius were recognized and he himself appreciated, success was attained and recognition secured —rewards granted to so few great discoverers before their death.

After considerable deliberation, Lister accepted an offer, made in 1877, of the position as clinical surgeon to Kings College, London. Even at that date his tenets had not secured universal recognition throughout England, due in large measure to "heartrending" failures of operators less painstaking than himself. It was in the hope that from this larger center he might more successfully spread the great truth of his discovery that he was finally induced to leave Edinburgh.

To ascertain the validity of his conception of the specificity of microorganisms in the production of "various complications of wounds" and further to corroborate his basal idea of microvital changes in the production of fermentation, Lister, sometime before he left for London, began work of a bacteriological character. By the time of his departure from Edinburgh he had, with technique worthy of Koch, isolated the "*Bacterium lactis.*" The account of this investigation and the results obtained he delivered as his opening address, when he assumed his new position. In this paper he epitomized Pasteur's teachings, amplifying them with new information derived from his own researches, which showed that milk had no inherent tendency to undergo lactic acid fermentation, but that it underwent this transformation rapidly when the specific "*Bacterium lactis*" flourished. From these facts he drew the conclusion that this property of fermentation must be kept in mind in regulating sanitary conditions in hospitals; that the greatest care must be taken to prevent the growth of the specific microorganisms causing sepsis."[17] This work was no small achievement, for it was probably the first isolation of a single microorganism having a specific action. Moreover, it gave added support to his conception that many and not one variety of microbes are concerned in the various processes of suppuration. Other papers along these lines appeared in the next two years, both on the special relation of microorganisms to fermentations, inflammations and diseases, and also their general relation to pathology. The facts disclosed by these investigations and the deductions made from them did not, however, obscure Lister's insight into the true nature of disease, for, quite in harmony with the teaching of to-day,[18] he maintained that some but not all inflammatory conditions were attributable to the baleful influence of bacteria. Indeed, he even went too far, for Dr. Welch, by his discovery of the *Micrococcus epidermidis* as the causative agent of "stitch abscess," set right an error made by Lister when he assumed that this lesion had as its sole etiology, anæmia, caused by too tight a suture.

As has been noted, the physiological and pathological properties of the blood had been, since Lister's first residence in Edinburgh, a field towards which he had often directed his efforts. In 1877 he observed that blood secured under antiseptic conditions neither clotted nor fermented. Hence he concluded that blood in itself had no inherent tendency to putrefy. Four years later, as an elaboration of this idea, he delivered a most suggestive paper demonstrating that intrinsically the blood had antiseptic properties. He obtained uncontaminated extra-vascular blood which remained sterile despite the addition of small amounts of putrefying material, thus demonstrating that, as he expressed it, "bacteria per se are unable to grow in normal serum and can only develop in that liquid when it has been vitiated, whether by the addition of water or the active products of putrefaction." This protective action he attributed to the serum and more particularly to the "pus cells," which he described as "rapidly peopling the lymph with vigorous new living elements." The importance of these observations can scarcely be overestimated, for they formed the common "anlage" from which were developed the two theories of immunity as conceived by Metchnikoff and by Ehrlich.

It may possibly appear that too much space has been occupied in setting forth Lister's work as an investigator and too little devoted to his other achievements. It was, though, by his work as an investigator that he gave surgery its most powerful weapon, while many an operator has done very reputable work, comparable in many respects, to that done by Lister. He was, however, a pioneer in many modern operations. Relying upon the assistance of antisepsis he dared to

[16] The Lancet, for October 11, 1884, has an editorial which would indicate that this grew to such an extent in Germany, that at that time it was held as malpractice not to employ "Listerism," in surgical treatment.

[17] "Just as the various fermentations had each its special microbe, so it might be in the various complications of wounds."

[18] Adami: Medical Record, March, 1896; ibid., Keen's System of Surgery, 1908; ibid., Principles of Pathology, 1908.

venture upon forbidden ground; to open and drain psoas abscesses, to explore joints and to perform osteotomy for the correction of deformity. His idea of wiring ununited fractures (patellar suture is a striking example of this) is a very valuable contribution. To him, also, we owe the successful revival of suprapubic cystotomy. Though in the treatment of mammary carcinoma his measures were not so radical and hence so successful as Halsted's, still to him must be given the priority in the removal of the axillary contents in the treatment of this form of tumor, an operation, according to Sir Hector Cameron, first performed by Lister in 1857. These and many other operations are attributable to his surgical ingenuity. They are ordinary procedures in our day. Their importance lies in the very fact that they still remain accepted surgical tenets and have led to many of those improvements which have created modern operative surgery.

As a teacher scarcely less than as a surgeon, Lister has left a name to be revered. "Intense loyalty" has been the universal homage paid him by his pupils and assistants. Aside from the great truths he gave his disciples, he had that priceless gift of stimulating enthusiasm among those who came under his personal influence. To those less fortunate, the plain lucidity and forcefulness of his contributions to medical literature afford an echo of his inspiring personality.

The sciences relative to medicine gained an impetus under the influence of Lister that is almost incredible. That of bacteriology, though not created by him, was surely elevated to its now important place by his demonstration of its application to the etiology of disease.[19] With the introduction of antisepsis all sciences requiring animal experimentation (physiology, pharmacology, physiological chemistry, etc.) were advanced in so great a degree that it is scarcely an exaggeration to state that the recent brilliant results obtained in these branches are due indirectly to Lister. With hardly an exception, all branches of medical practice have benefitted by the incorporation in them of Lister's theory of contagion and his principle of the prevention of suppuration.

To enumerate the honors, degrees and titles borne by Lister would make no small catalogue. Without going into detail, suffice it to say that the Royal Society has proffered him its highest honors, and the leading institutions of two continents, as well as Great Britain, have showered degrees upon him. He has been raised to the British peerage and is the recipient of foreign scholastic titles. More striking than these honors is the estimation in which he is held by the civilized world in its appreciation of what, by his direct and indirect efforts, he has bequeathed to mankind.

In 1893 Lister retired from his active position in King's College, becoming professor emeritus of clinical surgery and consulting surgeon to King's College Hospital. Three years later he retired from all practice, but not from scientific work, for some exceedingly suggestive contributions have come from his pen since then, notably that on "The Parasitology of Malaria." In the parlance of Hippocrates, it has been granted Lister "to enjoy life and the practice of his art, to arrive at a ripe old age honored, appreciated and revered," while his works will remain as a perpetual memorial of his devotion to mankind, to science and to his profession.

If this outline of Lister's achievements places his example on such a high plane that it can afford only an ideal, the absolutely unattainable, then indeed has the rehearsal been in vain, for surely in the life-work of Lister there is much that the young physician may find to emulate. There is unquestionably a ground upon which even the mediocre devotee of medicine can build to advantage. Even he can follow in some degree the plan pursued by Lister. To draft an uninterrupted sequence in one's work after there has been laid a substantial foundation on which to build; this is within the power of all. Look to Lister's life and see the striking consecutiveness of his work. See how his physiological observations chiefly on coagulation, followed by his pathological investigations into the nature and progress of inflammation, were, each in their turn, direct precursors in his mind of the relationship of microorganisms as a cause of surgical and traumatic inflammation; this leading to his ultimate and crowning feat of devising a method for the prevention of their access to wounds. Again there still remain opportunities as many and great as in his day for the cause and prevention of many an evil genius of Hygeia remains unsolved. Finally, he did not create antiseptic surgery suddenly and without means at his hand, for the way was already blazed by invaluable scientific facts. Leeuwenhoek, Schultze, Schwann, Schröder, Dusch[20] and others, but above all, Pasteur, had by their several contributions proved that all fermentations and putrefactions are due to ever-present microorganisms. Lister insisted time and again that he but seized upon Pasteur's discoveries and applied them to surgery. But he seized them because he was watching on the mountain tops. It was because of this, that "in the hot-fit of life, a tip-toe on the highest point of being, he passed at a bound onto the other side," where others had not been. And Lister was on the mountain tops because, practitioner though he was, he saw the value of the sciences. He turned for the accomplishment of his aim towards the domains of physiology, of pathology, of chemistry, of physics and of botany.

So it is that Lister carries us far. Better even than his inestimable gift to operative surgery, he teaches us by his methods of work that it is only by the assimilation of all cognate branches of learning; that it is only through the science of the relation of all knowledge to the necessary ends of medicine[21] that the profession is to gain in power and purpose; that by these means alone will the science of medicine of

[19] Ernst von Meyer ("History of Chemistry," page 593) confirms this statement.

[20] The introduction of "The Collected Papers of Joseph, Baron Lister" tells of the work each of these performed in the annihilation of the theory of abiogenesis.

[21] Kant, in his "Critique of Pure Reason" (translated by Müller), Vol. 2, page 719, defines Universal Philosophy—his "Conceptus Cosmicus"—as "The science of the relation of all knowledge to the essential ends of human reason."

to-day, arising out of the ashes of the art of medicine of yesterday, be further evolved into the philosophy of medicine of to-morrow.

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DECUSSATION OF THE PYRAMIDS—AN HISTORICAL INQUIRY.*

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It may, I think, be said that the first step in cerebral localization, based on actual observations, was that an injury to one side of the brain caused effects on the opposite side. How early this was known I do not know, but Hippocrates (460-377 B. C.), in his "Injuries of the Head,"[1] says: "And for the most part convulsions seize the other side of the body; for if the wound be situated on the left side, the convulsions will seize the right side of the body." This fact came later to be known as the law of "crucial conduction," and is in its broad sense universally accepted at the present time. Although this crossed association attracted the attention of a number of the ancient writers, and gave rise to some speculation, still it was not accepted as proven until well into the last century.

The development of our knowledge in regard to the simple fact of the passing of the fibers from one side of the brain to the other, particularly in regard to our first knowledge concerning the decussation of the pyramids, is my present interest.

Classical writers speculated much as regards the functions of the various organs of the body, and, of course, of the brain and its activities. It is not necessary before this audience to review the many opinions that were held. These were colored by the philosophy of the individual writer, and were usually only in a very slight degree based on actual anatomical knowledge.

Galen (130 A. D.) had, as you will remember, a fairly clear idea of the nerves and of the importance of the brain. He had reverted from the doctrines of Aristotle, who considered the brain as a moist, cool organ, which controlled the ardor of the heart, back to the older views of Hippocrates and Plato, that it was the seat of sensation, motion and of the intelligence. He made dissections of many animals and a number of experiments, and seems to have known nearly as much about the brain as Vesalius and Willis did.

Galen saw clearly that local disturbances of the nervous functions must depend upon focal disease of the nervous system, and he pointed out that to obtain a knowledge of these, clinical observation must be combined with careful anatomical and experimental investigation. It was to elucidate the question of paralysis that he[2] experimented on the spinal cord. He discovered that a total transverse section of the cord caused a total paralysis below it, that a hemi-section caused paralysis of the same side, and that a longitudinal division had no effect. He argued that as all voluntary power and sensation were derived from the brain, a total abolition of

* Read before the New York Neurological Society, April 5, 1910, and the Johns Hopkins Hospital Medical Society, April 11, 1910.

[1] Adams' Translation, p. 386.

[2] De locis affectis, lib. III, cap. XIV. De anatomicis admonstrationibus, lib. VIII, sec. 6.

these functions, as in apoplexy, indicated a lesion of this organ, but that a local effect, as in the arm or leg of one side or portions of these, as in paralysis, pointed to the spinal cord. When the face was involved, the disease must be in the brain, for the muscles of the head receive their nerves from this organ.

In these sections referred to, Galen does not mention the crossed effect of the brain. He seemed to regard the brain as acting as a whole, and to think that the functions were not segregated until they were distributed to the parts of the body through the spinal cord and nerves. The differing effects of injuries to different parts of the brain, he based on the assumption of a varying amount of abolition to the circulation of the psychic pneuma. Soury[3] quotes him as believing that in deep comas and epilepsies the ventricles are more affected than the body of the brain, while in apoplexies the latter is more affected. In deep comas the anterior parts are more affected; in apoplexy and epilepsy the anterior and posterior are equally so.

Aretaeus, about whose personality you will remember so little is known, but who is believed to have lived and written near the time of Galen, states this question very clearly and in quite a modern sense. He says: "If, therefore, the commencement of the affection be below the head, such as the membrane of the spinal marrow, the parts which are homonymous and connected with it are paralyzed: the right on the right side and the left on the left side. But if the head be primarily affected on the right side, the left side of the body will be paralyzed; and the right, if the on the left side."[4] From this quotation it is obvious that he knew of the facts proved by Galen's experiments on the spinal cord, and one is tempted to believe that he actually knew of Galen's investigations, and that he was, therefore, either contemporaneous with Galen or wrote after him.

In explaining the crossed relationship of the brain, Aretaeus says:

"The cause of this is the interchange in the origin of nerves, for they do not pass along on the same side, the right on the right side, until their terminations; but each of them passes over to the other side from that of its origin, decussating each other in the form of the letter X."

It will be seen that this explanation is not easily brought into accord with the statement of a homolateral effect of a lesion of the spinal cord, and is probably the expression of a current belief. Cassius Felix, who is believed to have lived during the reign of Tiberius (14-37 A. D.), and of whom both Celsus and Galen speak with approbation, gives this same explanation, and it has been thought by some that Aretaeus probably copied it from him.[5]

This idea was probably based on the crossing of the optic nerves, which is so obvious that it struck the attention of the earliest anatomists, especially those who dissected the lower forms of animals. Aretaeus does not refer to this, nor does he make any other strictly anatomical observations. Galen, on the other hand, did not regard the optic chiasm as a decussation, but a true union, where the images of binocular vision were combined before reaching the soul.[6]

The assumption of the crossing of the peripheral nerves as an explanation for the crossed effect of lesions of the brain, although based on practically no anatomical observations, was current up to the beginning of the last century.

The intellectual darkness of the following centuries obscured these clear views of Galen and Aretaeus, and during this time the conceptions regarding the nervous system appear to have been purely philosophical. In illustration of this I have taken the liberty of reproducing an interesting old diagram that Sir Victor Horsley[7] discovered in a MS. in the Bodleian Library, which was written in 1152, and is obviously based on the philosophy of Aristotle and not of Galen. It will be seen that the brain is not even indicated.

With the revival of classical learning in the Renaissance, the writings of the Greek physicians became current, particularly those of Galen, which actually dominated medical thought for many years. As anatomy began to be studied more and more from actual dissections of the human body, the views of Galen were revised, but it is interesting that the brain received but slight attention. A reference to the plates in the "Fabrica" (1543) of Vesalius (1514-1564) will show how little this part of anatomy interested him.

The tremendous intellectual activity of this period, especially along physical and mathematical lines, had its full influence on medical speculation. Descartes'[8] (1596-1650) fascinating attempt in 1662 to reduce the nervous system to an intricate "earthly machine" governed entirely by physical laws, is the most brilliant example of this.[9] He was a philosopher, and was impeded but little by accurate anatomical and physiological knowledge.

Willis (1621-1666), who worked at the same time, seems to have derived his philosophical views from Descartes, but his more accurate knowledge of anatomy and physiology of the nervous system, impeded him in his speculations. Sir Michael Foster,[10] however, has little regard for him as a philosopher, or, indeed, a man, and he thinks that even his anatomical knowledge was derived from his associate, Lower.

Willis[11] did, in fact, do much to advance our knowledge in regard to the structure of the brain. He paid much attention to the cortex of the cerebrum and cerebellum, where he thought the vital spirits were formed, to be distributed through the

[3] Le Système Nerveux Central, 1899, p. 296. Paris.

[4] The Extant Works of Aretaeus, etc., chap. VII, p. 305. The Sydenham Society, Lond., 1856.

[5] See Morgagni, Seats and Causes of Diseases, 1769, Vol. I, p. 53, sec. 19. London. Trans. by Benj. Alexander.

[6] Soury, ibid., p. 297.

[7] "The Structure and Functions of the Brain and Spinal Cord," London, 1892. Linacre Lecture. Brit. Med. Jour., 1909, July 17.

[8] See Sir Michael Foster's "Lectures on the History of Physiology," 1901, which contains a mine of information about the workers of this period.

[9] De Homine Liber. Quoted from Michael Foster.

[10] Ibid., p. 270.

[11] Practice of Physic, Treatise VI, Anatomy of the Brain, 1684, London.

medullary substance to the nerves. The corpus callosum he regarded as a sort of reservoir where the spirits from the cerebrum were collected and from which they passed out or to which they returned through the streaked bodies (corpus striatum). These latter structures he described as the beginning of the medulla, and regarded their striated appearance as indicating channels which directed the spirits. The medulla oblongata was a large and royal path, where the animal spirits, derived from their double source, the brain and cerebellum, always run abundantly. He says nothing of the crossed relationship of the cerebrum. Indeed, he seems to regard the division of the brain into two parts as being a conservative device, so that when one was injured the other could take on its function. However, in speaking of a case of hemiplegia, he explains it by the fact that one of the streaked bodies had been pressed upon, but in his description of the autopsy he neglects to mention whether this was on the side of the paralysis or on the opposite side.

"A young man of a sanguine temper, ingenious, and for the most part healthy, sitting in a chair after a large supper, and immoderate drinking of wine, was so distempered with a numbness or stupidity in his right hand, that his gloves, which he held in it, fell of themselves out of his hand; then getting up and endeavoring to walk, he felt a resolution or loosening in his thigh and leg of the same side, and a little afterwards falling into a certain hebetude or dulness of mind, and stupefaction, yet without an apoplexy; for he was still himself, answering aptly to questions asked him, though but slowly and with difficulty, and doing those things that were bid him. Presently a skillful physician being sent for, phlebotomy, vomiting, and purging were celebrated in order, cupping-glasses, scarification, ointments, frictions, and other fit administrations were carefully applied: nevertheless the palsy increased, that besides the motion of his members on the right side being taken away, he also lost the sight of that eye; yet still being stupefied and sleepy, he was compos mentis, and knew his friends, and being conscious of his infirmity, and solicitous for the recovering his health, he took all remedies were given him; but notwithstanding all this, the animal functions daily more and more languished, and at length by their consent the vital; so that about the seventh or the eighth day, from thence, falling sometimes into a delirium, and sometimes into convulsions, or other distractions of the animal spirits, his strength being at length quite lost, he yielded to death.

His head being opened, the anterior cavity of the brain was filled, partly with ichorous blood, partly concreted and in clodders or gobbets, with plenty of serum: Hence, as it is easy to conceive, from this deluge, pressing upon one of the streaked bodies, and binding up its pores and passages, the flowing of the spirits into the nervous appendix of that side was hindered, and for that reason, the resolution in the respective members was excited; and because of the optic chamber, where it is inserted into the streaked body, being also pressed together, the eye of that side lost its sight; further, because the callous body, chambering that den, was somewhat pressed by the heaped matter, from thence the hebetude and stupefaction of the chief functions of the soul were excited, yet without their subversion or inordination. By reason of the evil being fixed on the substance of the brain, and the spirits inhabiting it, these sorts of distempers do proceed, and not from the impletion of the ventricle, as appears clear enough by this instance, and by what we have elsewhere mentioned." [12]

Plate II gives his conception of the base of the brain.

[12] Ibid., p. 174.

Among the philosophical speculations of the time it is refreshing to read Stensen's [13] (1638-1686) protest, directed especially against the views of Descartes and Willis. He says: "There abounds indeed a rich plenty of men to whom everything is clear. Such, dogmatizing with the utmost confidence, make up and publish the story of the brain and the use of its several parts with the same assuredness as if they had mastered with their actual eyes the structure of so admirable a machine and penetrated into the secrets of the great artificer." He was the first to state clearly that to understand the workings of the brain, one must know the course of the fibers within its substance, for he says in another place: "If indeed the white substance, of which I am speaking be, as in most places it seems to be, wholly fibrous in nature, we must necessarily admit that the arrangements of its fibers is made according to some definite pattern on which doubtless depends the diversity of sensations and movements." [14]

Stensen's appreciation of the complexity of this pattern, and the importance of unravelling it, has been amply justified by the enormous amount of work which is even now being directed towards its elucidation.

The difficulty of this problem deterred the anatomists after Willis for many years, and no material advance, in the knowledge of the structure of the nervous system, was made for more than one hundred years, *i. e.*, until the end of the eighteenth century.

Along with the more frequent dissections of the human body, greater interest was taken in the morbid conditions found after death, and reports of autopsies began to accumulate. That the lesion in apoplexy was frequently found on the opposite side of the brain, aroused renewed interest in a number of observers.

Wepfer (1620-1695), who, in 1658,[15] first clearly pointed out the dependence of apoplexy on hemorrhage within the substance of the brain, refers to this fact when speaking of one of his own cases. He says:

"I do not indeed deny that these tumors of the ventricles may, in some measure, have conspired to the production of a hemiplegia in the left side; for I myself, with many others, have observed that one side of the brain being affected, the opposite side of the body had been seized with a palsy, but I believe that the concomitant and perhaps primary cause of the hemiplegia in this case was serum. . . . . Nor does it help forward the demonstration of this subject, that the left part of the spinal marrow was less than the right; for if it had been anything preternatural, the foot must have been incapable of motion equal with the arm." [16]

Dr. Donley, from his very thorough knowledge of Wepfer,[17]

[13] Discourse on the Anatomy of the Brain, 1669. Quoted from Foster.

[14] It is interesting to remember that Newton, in 1704, suggested that certain optical phenomena could be explained only by a partial decussation in the chiasm of the optic nerves—a deduction that had to wait many years for its confirmation.

[15] De Apoplexia. See Donley.

[16] Quoted from Morgagni, The Seats and Causes of Diseases, 1769, Vol. 1, p. 234, sec. 10.

[17] Johns Hopkins Hospital Bull., Jan., 1909, "John James Wepfer, a Renaissance Student of Apoplexy."

kindly writes me that this author, although he knew that at times the lesion was found opposite to the paralyzed side, as the case quoted above shows, still thought that, as a rule, the lesion was to be looked for on the same side, and was surprised when he found the opposite condition and usually hunted for some other cause for the paralysis.

Morgagni[18] claims for his master, Valsalva (1666-1738), the credit of having demonstrated that in hemiplegia the lesion should be looked for on the opposite side of the brain, for although this had been seen by Wepfer and many other observers, it was passed over without remark.

The importance with which Morgagni regards this may be gathered from the quaint description which he gives of a case of apoplexy occurring in a man forty years old, who was admitted to the hospital in February, 1703. Upon being brought to the hospital "the physician ordered his legs and his feet to be vehemently rubbed, spirit of salt ammoniac to be applied to his nostrils, and even some drops of it in a proper vehicle to be poured into his mouth, and the blood to be taken away from his arm, on which side he was most affected with a paralysis."[19] This treatment proved ineffectual and the patient died.

When Morgagni was about to do the autopsy, Valsalva came into the room. "Then Valsalva said to me, this apoplexy, unless my observation fails me, was brought on by blood injuring the right side of the brain."

I have been unable to discover that either Valsalva or Morgagni theorized as to the cause of the crossed relationship.

This, however, cannot be said of a fellow-countryman and contemporary of theirs, Domenico Mistichelli, professor of medicine in the University of Pisa, who wrote a book on apoplexy, which was published in Rome in 1709.[20]

In this work he speaks of the crossed relationship as a well-recognized fact, and endeavors to explain it by a new view of the anatomy of the nervous system. This author would hardly justify special attention were it not that to him is often given the credit of having first demonstrated the actual decussation of the pyramids (Gall, Neuburger, Landois, etc.).

Mistichelli's view was unique. He thought that the substance of the brain and medulla was without structure, but that the membrane (pia mater?) which surrounded them was composed of fibers which interlaced among each other in a most intricate manner, which he likened to the braid of a woman's hair. It was from this membrane that the nerves took their origin. Plate IV gives his diagram.

It will be seen that he supposed the surface of the pons to be formed of transverse fibers which passed up over the medulla, to cross and to go forward again, and so be plaited about the spinal cord. There were other longitudinal fibers which seemed to arise also from the pons, and also many others.

This book, you will remember, is on apoplexy, and in Chapter VIII he explains how a lesion on one side of the head results in a paralysis of the opposite limbs, and says, in Section II:

"To explain these facts it is necessary to remember that which was recently established by myself, namely (d) that the medulla oblongata is on the outside, interwoven with fibers, which by their criss-cross superposition, resembles a woman's braid, whence it comes that many nerves which branch out on one side, have their roots on the other. For instance, those which extend to the right arm may easily, by such an arrangement, have for roots the left fibers of the meninges, and in the same way the left may proceed from the right. This probably applies to many, if not to all, the nerves which have their origin immediately from the spinal marrow."

This he considers sufficient explanation of why, if the flow of the animal liquid be impeded on one side of the brain or medulla, the effects will be on the opposite side of the body.

The book, after all, is written for the primary purpose of advancing a new and signal cure of apoplexy, *i. e.*, the burning of the soles of the feet with a hot iron. Figure 4, Plate IV, shows the exact position where the cautery is to be applied, and it is probably to commemorate this important discovery that the frontispiece was designed.

Mistichelli's explanation differs from that given by Aretaeus only as to his fanciful anatomical ideas, and it is remarkable that he is so often spoken of as the discoverer of the decussation of the pyramids.

Of quite another character is the work of Francois Pourfour du Petit (1664-1741), who became interested in this subject while serving with the French Army in Flanders. He published his results in a little pamphlet entitled "Lettres d'un Medecin," etc., Namur, 1710, only 200 copies of which seem to have been printed, so that the book is one of the very rare medical works. I have not been able to find any copy in America, but Dr. Osler was so kind as to look at the copies in Paris and in London. He had some of the pages photographed from the London copy, and I am able to show you some slides from it. As you will see, Petit's name is not on the title page, and of the Paris copy, Dr. Osler writes that there is "no name on the title page, but in ink written 'par Francois Petit.'"

In the London copy this inscription is found:

Pourfour Du Petit—M. de Mayran gave a Eulogy of him in the Royal Academy of Science, in the year 1741. There is to be found a brief note of this book, p. 174 [translated as follows]:

"A life that was largely itinerant and little adapted to contemplation necessary for the composition of works, did not prevent M. Petit from publishing, in 1710, three dissertations in the form of letters, which were printed at Namur under the title of "Lettres d'un Medecin." He only had 200 copies printed which makes the work infinitely rare, and which necessitates our giving some idea of it. It is a little book in 4°, filled with facts, observations and experiences, etc." See the Eulogy, cited above.

This piece is marked with an asterism of approbation by M. de Haller in his Catologas Editiorum Librorum quobus Auctor, etc., subjoined to the last volume of his Elementa Physiologie, p. 223.

[18] The Seats and Causes of Diseases, 1769.

[19] Ibid., Letter III, sec. 16.

[20] Trattato Dell Apoplessia. This appears to be an extremely rare work, and the only copy of which I have been able to hear, nearer than Rome, is in the library of Harvard College. Through the courtesy of the librarian I have had an opportunity of seeing the work, and am able to show you the photographs of the title-page, frontispiece, and one of the plates. I have also photographs of certain of the pages which were most kindly made for me by Prof. Bastianelli from the copy at Rome.

Of the first "Lettre" Dr. Osler says:

"It is really a remarkable production. He first deals with the question, much discussed, as to the paralysis on the side opposite to the cerebral lesion, and refers to many old cases from Aretaeus and others. Secondly, he gives an interesting series of his own cases in which after injuries or disease (usually abscess) he found the brain lesion opposite to the affected side. Thirdly, he gives a series of "Experiences" (experiments) on dogs, in which after injury to or removal of part of the brain on one side, the paralysis was always on the opposite.[21] Lastly, he discusses the anatomy and gives a beautiful figure of the medulla and upper part of the cord, showing as clearly as Quain or Grey, the decussation of the pyramids."

Petit's description is as follows:

"Each pyramidal body divides at its inferior part into two large handfuls of fibers, more often in three and sometimes in four. Those of the right side pass to the left, and those of the left side pass to the right, reuniting with each other, as seen in *D*, in the first figure."

This, I believe, is the first actual observation of the decussation of the pyramids, and based as it is on clinical, experimental and anatomical observations, is surely a most noteworthy contribution, particularly when compared with the current knowledge of the times and such work as that of Mistichelli.

Petit's master in anatomy, Duverney (1648-1730), also describes the decussation, and says: "When the pyramidal eminences are raised, one sees, near their extremities, two or three bunches of fibers, of which some pass from the right side of the medulla to the left, and others in the reverse direction." The drawing which he gives is clearer, although somewhat more diagrammatic, than Petit's.

This plate and quotation are taken from a posthumous work,[22] which was published thirty years after his death, which occurred twenty years after the publication of Petit's "Lettres," and it seems reasonable to believe that he had incorporated his student's work, although neither he nor his editors make reference to Petit in this connection.

It is interesting that upon Duverney's retirement from the Royal Academy, Petit took his place, and was later appointed, in association with Winslow and Morand, after Duverney's death, to edit some of his notes on natural history.

That Mistichelli is so often coupled with Petit as having discovered the decussation of the pyramids, shows how little was known of the observations of either of them.

The generally accepted view at the time of Petit's work may be gathered from the description given by Thomas Gibson (1647-1722),[23] who seems to have been the most authoritative English anatomist of that time. He describes the spinal cord as being divided into two parts from its origin at the junction of the crura to its end, and says (p. 398):

"The partition is made of the pia mater and by means of it it is that the use or motion of one side only is sometimes taken away in these palsies."

This view of the almost complete separation of the two sides of the spinal cord was very firmly fixed, and Monro, 2d (1733-1817), probably in criticism of the work of Winslow, Haller and others, says:

"We have observed that the right and left sides of the spinal marrow are divided from each other by deeper fissures than have been described by many late writers, or that the right and left sides of it are less intimately connected than is commonly imagined. From attention to this circumstance, we are, in some degree, enabled to explain the cause why one side of the body is much palsied, whilst the other preserves its powers unimpaired, or to understand the cause of hemiplegia." (Chapter XI.)[24]

Monro's plate (X) of the base of the brain gives no suggestion of the decussation of the pyramids.

Sir Charles Bell himself, in his early dissections of the spinal cord, was governed by the same belief, and traced the anterior columns directly into the same side of the cerebrum.

Santorini (1681-1737) is also credited with having demonstrated the decussation of the pyramids.[25] He refers to Mistichelli's observations, and says on account of their obscurity that they have been doubted by many, but that he (Santorini), himself, has shown these crossed connections so completely that no one can longer doubt. He describes them as occurring in three different places, but his description is difficult to understand, and the copy which I had the opportunity of examining contained no plates.[26]

Winslow (1669-1760) also, and a number of other authors, described more or less intimate connections between these two sides, and he believed that he had confirmed Petit's observation, for after speaking of the spinal cord as taking its origin from the pyramids and olives, structures, the names of which he reverses, and describing the fissures of the cord, says[27] (p. 110):

"When we separate these ridges with the fingers we observe a crucial intertexture of several small medullary cords which go

[21] Neuburger, Die Historische Entwicklung der Experimentellen Gehirn und Ruckenmarksphysiologie vor Flourens, p. 52, et seq., speaks somewhat more in detail of the experiments, and says that Petit usually trephined over the middle of the parietal lobe, and inserted a scalpel in various tracts and varying depths. As a result of these procedures, he found paralysis always of the opposite extremity, but he noticed that this paralysis was only complete when the corpus striatum was injured, for if the injury was confined to the cortex there was no real paralysis but simply a weakness of the opposite side.

[22] Oeuvres Anat., 1761, Vol. 1.

[23] Anatomy of Human Bodies Epitomized, 1703, London, VI Ed.

[24] Observations on the Structure and Functions of the Nervous System, 1783, Edin.

[25] Observ. Anat. Lug. Bat., 1739. Cap. 3, sec. 12, p. 61.

[26] Yelloly (cf. p. 24) says: "Santorini referred the place of decussation to the tuberculum annulare, as well as to the medulla oblongata; but was induced to consider it as taking place in the latter, from the circumstance of the existence of fibers, which appeared to him to decussate. We are informed, however, by Vicq d'Azyr, that M. Girardi, the editor of the posthumous works of Santorini, examined 34 brains in order to ascertain whether the decussation mentioned by him takes place, but was not able to convince himself of the fact. Vicq d'Azyr himself considers the fibers as nothing more than commissures, and not at all connected with the phenomenon in question."

[27] An Anatomical Exposition of the Structure of the Human Body. Trans. by G. Douglas, 1756, Ed. IV, London.

obliquely from the substance of one lateral portion into the substance of the other. M. Petit, Member of the Royal Academy of Science, and Doctor of Physick, is the author of the discovery by which we are able to explain several phenomena both in physiology and pathology."

Winslow does not mention just where he sees these crossing fibers, nor do any of his plates indicate that he actually saw the decussation of the pyramids.

Haller (1708-1777), to whom we owe so much in regard to the physiology of the nerves and muscles, gives a very similar description.[28] In speaking of the fissures of the cord he says: "Each of these sulci is continued down along the medulla spinalis, the anterior most evidently; the posterior less so. In the former transverse fibers are detected from the right to the left, both in the medulla oblongata and spinalis" (p. 166, 1st Am. Ed.). These transverse fibers he regards as analogous to other bands which connect the two sides of the nervous system, and adds: "And most of them join the right and left parts together, as the anterior commissure and the two posterior, the corpus callosum, the striæ between the process from the cerebellum to the testes and the medullary crossbars, in the bottom of the third ventricle, and in the medulla oblongata and spinalis" (p. 185). This, he thinks, explains the crossed paralysis, but he also thinks, as did Willis, that it is a contrivance by which each side of the body is supplied with nervous energy from both sides of the brain, so that an injury to the brain does not always paralyze.

Boruttau[29] says that Haller accepted with enthusiasm Petit's view, but gives no exact reference, and this, I think, can hardly be possible from the quotation given above.

Vicq d'Azyr (1748-1794) seems also to have regarded these connections as commissures.

Many more citations could, without doubt, be given, but these are sufficient to show that du Petit's discovery had either been overlooked or misunderstood, and that the decussation was practically unknown when Gall, the phrenologist, again called attention to it.

Francis Joseph Gall[30] (1758-1828), as an anatomist of the nervous system, appears to me to be far ahead of his generation. He believed that the white or fibrinous matter of the central nervous system was directly related to the gray or cineritious substance, and that this latter in some way formed the former. All the nerves, both cranial and spinal, he believed to arise from the medulla and spinal cord. The brain he regarded as an outgrowth from the cord, and as being composed of excurrent and recurrent nerves, or, as we would say, afferent and efferent. The cortex was a peripheral mass of gray matter, or ganglion, and in some way gave rise to the recurrent nerves. In tracing the pyramidal fibers, he showed that they passed through masses of gray matter, from which they seemed to receive fibers, and he pictures very beautifully their decussation at the lower part of the medulla oblongata.[31]

Although Gall had been demonstrating the brain in the capitols of Europe for a number of years, it was not until 1810 that he, in association with Spurzheim, published the first volume of his work, but a year previous the commission appointed by the Class of Mathematical and Physical Sciences of the National Institute of Paris, reported on a memoir[32] which these authors had presented.

Gall and Spurzheim had a thorough knowledge of the literature and refer to Petit's work, but give Mistichelli the credit of the first discovery, and make many other references which were generally copied by subsequent writers.

In speaking of Gall's demonstration of the decussation of the pyramids the commission says (p. 57):

"How has it happened that a point of structure so evident, adopted by Winslow, Lieutard, Portal, distinctly described and plainly delineated by Santorini, should have been doubted by the great Haller, recently denied by very skillful men, and confounded by others, among whom may be reckoned Vicq d'Azyr himself, with that of the transverse fibers which unite, in their whole length, the lateral parts of the medulla oblongata?"

The opposition which was aroused by Gall's peculiar phrenological views, and his somewhat startling method of their exploitation, probably accounts for the tardy acceptation of his anatomical discoveries.

An excellent illustration of the attitude of the best medical thought at the beginning of the last century, in regard to the crossed relationship of the brain, can be gathered from a paper read in 1808, by John Yelloly, concerning a patient who died with a tumor involving the lateral side of the pons, and which caused paralysis of the VI and VII nerves on that side, together with the opposite arm and leg.[33]

In relation to this case, Yelloly was particularly interested in the question of the conduction of the nervous impulses in the spinal cord and says:

"I shall consider whether there is reason to suppose that nervous energy, in whatever that may consist, is in its progress to the spinal nerves confined to the particular side from which these nerves proceed; whether it is subject to any decussation; or whether it is equally dependent, for its propagation, on the whole spinal column."

In the body of his paper he does not even refer to the decussation of the pyramids, but speaks of the older views of Galen, Aretaeus and some of the modern writers who accepted them. He got his friend, Sir Ashley Cooper, to make hemi-sections of the spinal cord to confirm Galen. In a footnote he refers to the report of the commission on Gall's work, but points out

[28] Physiology, etc., 1754, London. Also first American edition, Troy, 1803.

[29] Neuburger and Pagel: Handbuch der Geschichte der Medizin, 1901-3, Vol. II, p. 355.

[30] Renewed interest is being taken in this remarkable and picturesque man. The fact of the "Gall Society" is an evidence of this. See "The Unknown Life and Works of Dr. Francis Joseph Gall" by Bernard Hollander, being an inaugural address delivered before the "Gall Society" on May 15, 1909. Published by Siegle, Hill & Co., London.

[31] Anatomie et Physiologie du Système Nerveux en Général et du Cerveau en Particulier, etc., Paris, 1810.

[32] Report by Fenon, Portal, Sabatier, Pinel and Cuvier. Trans. Edin. Med. & Surg. Journ., 1809, Vol. V, p. 36.

[33] "A Case of Tumor of the Brain," Medico-Chirurgical Trans., 1809, Vol. 1, p. 181.

that even if the decussation of the pyramids were true, it could hardly explain the paralysis of the face on the same side as the limbs, as this occurs after the giving off of the facial nerves, and that the cerebral influence must cross the middle line somewhere above the origin of the facial nerve.

Even the mere fact of the crossed relationship was doubted, and John Cheyne (1777-1836), in his interesting monograph on apoplexy,[34] writes concerning this point that he is only justified in saying that his dissections tend to confirm the observation that the blood is generally extravasated in the hemisphere opposite the side of the body which is paralyzed, and Craigie (1793-1866), as late as 1850, wrote: "Palsy of the opposite side, though frequent, is not an invariable result of injury of the brain."[35]

However, in 1853, Romberg (1795-1873), in speaking of cerebral localization, says: "The fact that is most positively established, and is scarcely threatened by a single exception, is the law of crucial conduction (p. 416)."[36]

As has already been pointed out, Gall's views made but little impression on anatomists in general. Sir Charles Bell (1775-1842), in the development of his idea of a new anatomy of the brain, appears to have entirely disregarded them, although he can hardly have been ignorant of them.[37]

You will remember that he believed that the nerves differed in function, depending upon the part of the brain to which they went, or from which they arose, and his particular interest was in elucidating this point by dissection. He early got the notion[38] that the posterior roots differ from the anterior in function; that the anterior were motor and that the posterior were sensory. He traced the anterior roots from the anterior columns of the spinal cord, and traced these columns up through the medulla, pons and into the cerebrum, at first taking no notice of the decussation, but later, in a paper read before the Royal Society in 1834, he gives a very beautiful drawing.

In this paper, while speaking of the functions of the different parts of the central nervous system, he says:

"It will not be denied that the most unequivocal proof of the little success that has attended the efforts made to improve this part of physiology, is the failure of all attempts to explain the phenomena which attend injury of the brain; it is neither said why, in disease of the brain, sensation and motion should be lost together, nor why one faculty should sometimes be imperfect and the other entire. There is no satisfactory reason given for the most common occurrence in practice, the loss of motion and sensation on the side of the body opposite to that side of the brain which has received the injury; nor has the condition of the face, as associated with that of the body, been accounted for. When circumstances so remarkable present themselves daily, consequent upon accident or disease affecting the brain, without our teachers succeeding in offering a satisfactory reason for them, it is obvious that we are in a state of profound ignorance of the most interesting functions of the animal body, notwithstanding the innumerable experiments which have been made upon the brains of animals."

He thought that dissection as he practised it was the only thing that could unravel this point, and says:

"On this plan I now propose to demonstrate that sensibility and motion belong to the cerebrum—that these two columns descend from each hemisphere—that one of these, the anterior, gives origin to the anterior roots of the spinal nerves, and is dedicated to voluntary motion—and that the other (which from its internal position is less known) gives origin to the posterior roots of the spinal nerves, and to the sensitive root of the fifth nerve, and is the column for sensation.

"Further, I propose to show that the columns of motion which come from different sides of the cerebrum join and decussate in the medulla oblongata—that the columns of sensation also join and decussate in the medulla oblongata. Finally, that these anterior and posterior columns bear, in every particular, a very close resemblance to one another—that is to say, the sensorial expansions of both are widely extended in the hemispheres: they pass through similar bodies towards the base of the brain, and thus concentrate and decussate in the same manner, thus agreeing in every respect except in the nervous filaments to which they give origin."

He at first traced the posterior roots into the posterior columns, and these he traced into the cerebellum, and his first idea was that this was the sensory part of the brain. This view, however, was so contradictory to his general view, that motion and sensation were always together, that he later traced the posterior roots into the lateral columns (Plate XIII, Figs. 2 and 3, Fig. 4, *c*) and these he dissected up to the medulla, discovered that they decussated (Plate XIV, Fig. 2, *c;* Plate XV, Fig. 5, *d*) joined in a single bundle, then separated (Plate XV, Fig. 5, *ee;* Fig. 6, *aa*) proceeded to the cerebrum, passing through or ending in the optic thalamus, whereas the motor tracts he traced to the corpus striatum and beyond.

One is struck by the ingenuity with which Sir Charles Bell traced his tracts, and although his dissections were in part factitious, still that he did actually announce the fillet as the sensory tract of the brain is certainly astounding. Plate XVI

[34] Cases of Apoplexy and Lethargy, 1812, London.

[35] Elements of General and Pathological Anatomy, 1851, 2d ed., p. 310. Philadelphia.

[36] Diseases of the Nervous System, 1853, Vol. II. New Sydenham Soc.

[37] The only reference to Gall that I have found is in his paper, "On the Nerves of the Orbit," read before the Royal Society, June, 1823.

He says: "The most extravagant departure from all the legitimate modes of reasoning, although still under the color of anatomical investigation, is the system of Dr. Gall. It is sufficient to say, that without comprehending the grand divisions of the nervous system, without a notion of the distinct properties of the individual nerves, or having made any distinction of the columns of the spinal marrow, without even having ascertained the difference of cerebrum and cerebellum, Gall proceeded to describe the brain as composed of many particular and independent organs, and to assign to each the residence of some special faculty.

"When the popularity of these doctrines is considered, it may easily be conceived how difficult it has been, during their successive importations, to keep my pupils to the examples of our own great countrymen. Surely it is time that the schools of this kingdom should be distinguished from those of other countries. Let us continue to build that structure which has been commenced in the labours of the Monros and Hunters, and which the undeserved popularity of the continental system has interrupted."

[38] "Idea of a New Anatomy of the Brain." Printed for private circulation, probably in 1811.

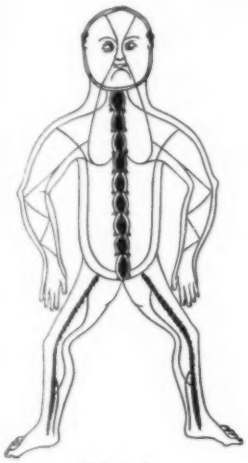

PLATE I.

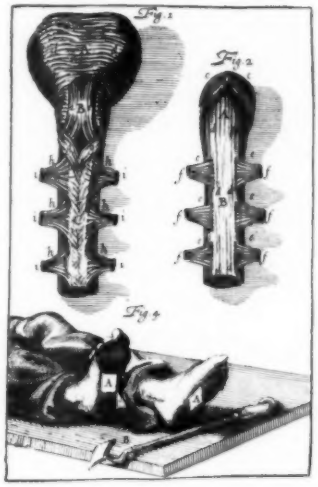

PLATE IV.

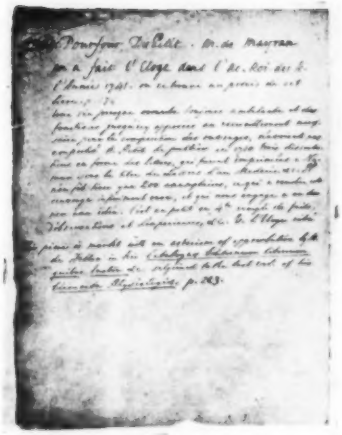

PLATE VII.

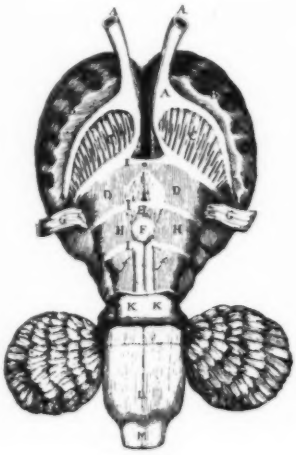

PLATE II.

PLATE V.

Chaque Corps Piramidal se divise à sa partie inferieure en deux grosses Manipules de Fibres, le plus souvent en trois & quelquefois en quatre. Celles du côté droit passent au côté gauche, & celles du côté gauche passent au côté droit, en s'engageant les unes entre les autres, comme on le voit en D dans la premiere Figure.

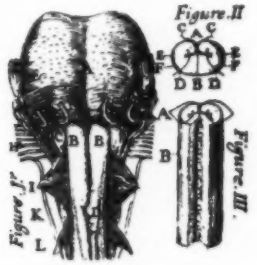

FIGURE II.

Elle répresente la Moelle de l'Epine coupée en travers.

PLATE VIII.

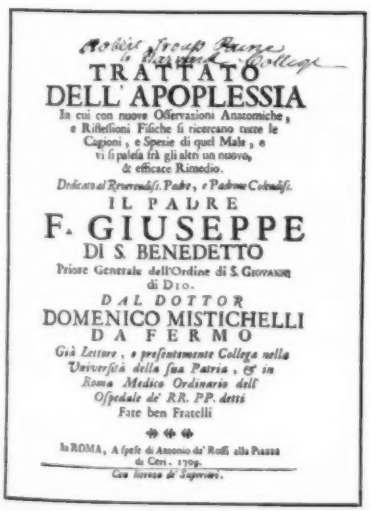
TRATTATO
DELL' APOPLESSIA
In cui con nuove Osservazioni Anatomiche, e Riflessioni Fisiche si ricercano tutte le Cagioni, e Specie di quel Male, e vi si palesa frà gli altri un nuovo, & efficace Rimedio.
Dedicato al Reverendiss. Padre, e Padrone Colendiss.
IL PADRE
F. GIUSEPPE
DI S. BENEDETTO
Priore Generale dell'Ordine di S. Giovanni di Dio.
DAL DOTTOR
DOMENICO MISTICHELLI
DA FERMO
Già Lettore, e presentemente Collega nella Università della sua Patria, & in Roma Medico Ordinario dell' Ospedale de' RR. PP. detti Fate ben Fratelli
In ROMA, A spese di Antonio de' Rossi alla Piazza di Cen. 1709.

PLATE III.

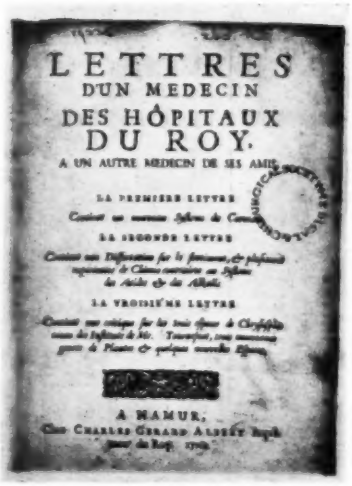

PLATE VI.

PLATE IX.

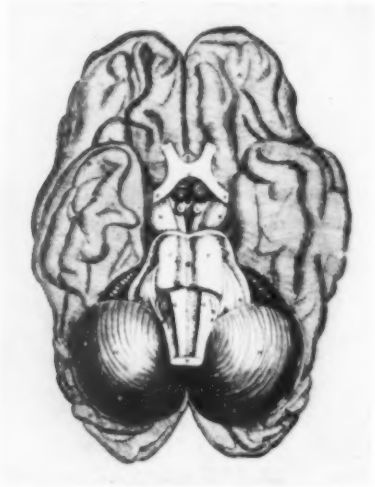

PLATE X.

PLATE XII.

PLATE XIV.

PLATE XI.

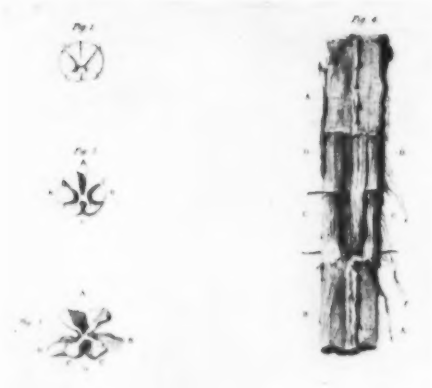

PLATE XIII.

PLATE XVI.

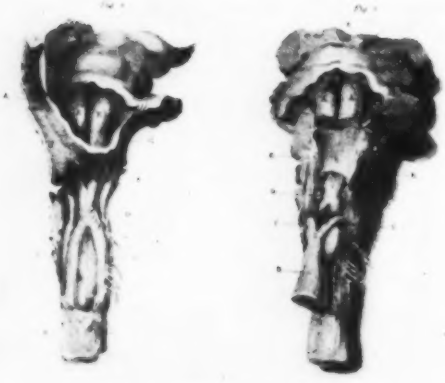

PLATE XV.

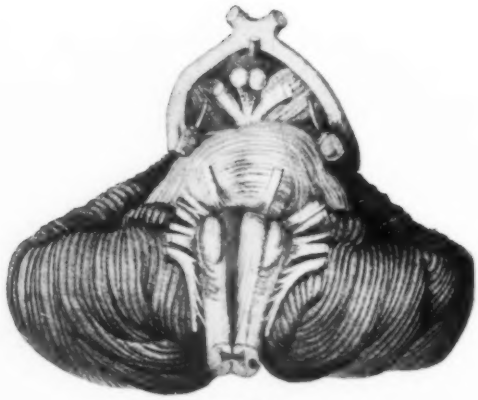

PLATE XVII.

gives a lateral view of these two tracts—the motor, *c;* the sensory, *e.*

Sir Charles Bell speaks with some derision of those physiologists who considered that finding a few fibers that decussated at the bottom of the pyramids explained satisfactorily the loss of sensation and motion, for he points out that they did not know the functions of these tracts, and did not appreciate that they were entirely motor, and so could not explain the loss of sensation, and that it was not until his demonstration of the decussation of the sensory fibers in the medulla that a real understanding could have been had. He entirely overlooked Galen's experiments on hemi-sections of the cord, and their confirmation by Sir Ashley Cooper—an illustration of how he was misled by his dependence on anatomical investigations, rather than on physiological experiments.

One would suppose that after its rediscovery by Gall, and the beautiful dissections of Sir Charles Bell, that the decussation of the pyramids would have been generally accepted. This, however, was not the case. Craigie,[39] in the 1851 edition of his work, denies it absolutely. He was familiar with the literature, and seems to have even confirmed the references in the original. He contended that the only decussation that had been proved was that of the restiform processes, and says: "Neither the pyramidal nor the olivary, nor even the whole of the restiform bodies partake of it" (Amer. Ed., p. 260).

This uncertainty in regard to what to us seems such a simple obvious fact, is not to be wondered at when we remember that for its satisfactory explanation there had to be an accurate knowledge of at least some of the tracts within the central nervous system, and of how far from complete our present knowledge is in regard to any one of them.

It must be remembered that the methods were not such that were adapted to unravel the intricate course of fibers within the nervous system, that although assumed by many authors, it had not been proved that the nerves arose from cellular elements in the gray matter.

Albert von Kolliker (1817-1905), even as late as 1850, assumed that practically all the nerves arose from the brain, and that the spinal cord was a mere cable.[40]

As the histological methods became more developed the origin of the nerve-fibers from the nerve-cells was demonstrated. Schroeder van der Kolk (1797-1862) claims to have been the first to have demonstrated this fact clearly. However this may be, it was about this time, and due to his work and that of other investigators, Lockhart Clarke among others, that this was thoroughly established. The experiments of Van Deen, Brown-Sequard, Stilling and many others, had determined much in regard to the physiology of the nervous system, and had also given rise to various theories as to the paths of conduction, etc., but it was not until the effects of secondary degeneration were studied, first by Turck,[41] and then by Bouchard, Charcot, etc., that our modern conception of the tracts within the nervous system began to be evolved.

Cruveilhier[42] had first called attention to the fact that lesions of the brain affect the nutrition or size of the brain stem, although he was unable to see that they had any effect on the spinal cord. This he thought likely. It is interesting to remember that Wepfer, in a case of lesion of the brain, noted that the contralateral side of the cord was smaller, but he did not bring these two facts into relation; indeed, he thought there was no relation (quoted from Morgagni; referred to above).

Turck described with fair accuracy the secondary degenerations which followed lesions in various parts of the central nervous system. He confirmed the decussation of the pyramidal tracts, and he recognized the existence of a direct tract which ran down the ventral columns of the cord without decussation. His plates were very crude.

Bouchard[43] continued and extended this work, and gave much more accurate pictures. I show the diagram.

Flechsig's[44] study of the tracts of the central nervous system by the method of the time of their myelinization, added much to our knowledge of the exact course of the various tracts, and especially to our knowledge of the decussation of the pyramids.

With these methods, and with others that have been advanced since, modern investigation is still concerned, and I shall not presume to speak of them before this audience.

[39] Elements of General and Pathological Anatomy. First ed. published 1828. Amer. reprint, 1851. Philadelphia.

[40] Mikroskopische Anatomie oder Gewebelehre des Menschen, 1850. Leipzig.

[41] Ztschr. d. k. k. Gesellsch. d. Aerzte zu Wien (1852) II, 511: (1853), II, 289.

[42] Anatomie pathologique, liv. XXXII.

[43] Archives gen. de méd., 1866.

[44] Die Leitungsbahnen in Gehirn und Ruckenmark des Menschen, 1876. Leipzig.

AN HISTORICAL SKETCH OF BLOOD-LETTING.*

By JOSEPH T. SMITH, SR., M. D., Baltimore, Md.

The practice of blood-letting is one of the oldest; it has been used to combat disease for more than two thousand years, and the earliest medical writers make mention of it, but its origin is unknown.

Hippocrates drew blood from the arm, feet, legs, forehead and from under the tongue, employing the measure as a simple evacuant, as a derivative for the purpose of giving the blood and animal spirits free movement in cases of apoplexy and palsy because stagnation was believed to exist and to cool the body. He recommended its use in violent and acute diseases in the strong, particularly those in middle life, but thought it harmful in the very young, the old and feeble. If the occa-

* Read before The Johns Hopkins Hospital Historical Club, February 14, 1910.

sion seemed to require it, he did not hesitate to take enough blood to produce complete syncope, taking as his guide the color of the flowing blood; if this changed from red to dark or from dark to red, the flow was stopped. His bleedings seem to have been done only for the relief of pain, a vein being opened as near as possible to the part affected, no matter how high, or ardent as the expression was, the fever ran, blood was not drawn unless inflammation was present. It is of interest to note that Hippocrates makes no mention in his writings of the amount of blood necessary to be drawn. He does not appear to have practiced arteriotomy nor to have known the use of leeches.

Erasistratus and his followers caused the practice to fall into disuse; they thought the loss of blood, in addition to abstinence, would weaken the patient too much, that it was often difficult to discover the proper vein to open and there was danger of opening an artery; they furthermore believed that it was not possible to know what quantity of blood to take—if too little, good results would not follow, if too much, the patient might die and lastly they feared lest the escape of the blood might be followed by that of the animal spirits.

Asclepiades brought blood-letting to the front. He believed that all phenomena of living bodies were dependent upon the motion of corpuscular atoms through corresponding pores and that disease consisted in a want of correspondence between those corpuscles and pores; hence he used scarification with cupping to open the pores. Pain seems to have been his guide in the use of the lancet; in cases of inflammation without pain no blood was taken; thus pleurisy called for blood-letting, not pneumonia.

Aretaeus and Celsus were very favorable to the practice; the former used small and frequent bleedings rather than one large one. He seems to have been among the first to draw blood from the arteries, and he bled to produce relaxation of the solids in order to facilitate the passage of urinary calculi, etc. Celsus made a critical and extensive study of the subject and was bold in the practice in that he did not consider the age, only the strength of his patient, and he determined the strength by the quantity and quality of the blood; he would not bleed before the second day, as the humors were still crude and not ripe for evacuation, nor after the fourth, as by that time the bad humors would have been spontaneously dissipated or have made their full impression upon the system; he confirmed the observation of Hippocrates, that a change in the color of the flowing blood meant harm.

Phlebotomy seems to have held its own down to the time of the vain but meritorious Galen, who appears to have been the first to note the amount of blood which should be drawn, the largest quantity he speaks of being one pound and a half and the smallest seven ounces; he bled when the fever was lowest and on the affected side.

Avicenna and the Arabian physicians followed the Greeks. They took issue with Hippocrates, as they believed, in cases of pleurisy that blood should be drawn from the side opposite the disease, a trivial matter from our viewpoint, but at the time it caused many great and earnest discussions in the schools of physic. Volumes were written and published in support of the two sides and the dispute became so great that the University of Salamanca issued a decree that no one should dare to let blood from the side affected and to add authority to the decree, endeavored to procure an edict from Charles the Fifth alleging that the contrary practice was as prejudicial to the community as Luther's heresy itself.

Among the Egyptian physicians blood-letting was practiced to a very great extent, both arteries and veins being opened. They had no dread of opening an artery, although they exercised great care. A ligature was applied and when the artery was distended, the smallest incision possible to admit the flow of blood was made with a very sharp instrument; after sufficient blood was taken, lint was placed over the wound, on this a coin and the whole was firmly bound down for three days.

The history of blood-letting is a long and interesting one; we learn from it that the practice has failed to secure a firm and well-defined position. In 1830, in the June number of the "Baltimore Monthly Journal," three pages are devoted to a selected review of a proposed "plan for the investigation of the due administration of blood-letting, by Marshall Hall, M. D." The review says: "No remedy is now more general —not even calomel or blue pill—and this fact may assure us that no remedy is more abused."

A review of blood-letting during the ten years, 1830-1840, when it was extensively practiced and at a time when medical practice was to a large extent freed from the myths and legends of the ancients, will give us the best insight into the subject, and for that purpose we have made free use of the books before us: "Lectures on Blood-letting," by Henry Clutterbuck, M. D.; "The Blood," by F. Magendie, M. D.; "Curiosities of Medical Experience," by J. G. Millenmen, M. D.; "The Baltimore Monthly Journal of Medicine and Surgery," 1830; and "A Treatise on the Blood, Inflammation and Gunshot Wounds," by John Hunter, with notes by James F. Palmer.

It may be of interest to note first the earlier opinions held in regard to the blood and circulation. One of the controversies was in regard to the life characters of the blood, was this fluid in whole or in part endowed with life or was it merely a dead fluid material from which the living matter was formed? John Hunter seems to have been the first to establish a rational system and a reference to his beliefs and opinions may not be out of place. He thought that life existed in every part of the body and studied the blood with that understanding. He says: "The difficulty of conceiving that blood is endowed with life while circulating arises merely from its being a fluid and the mind's not being accustomed to a living fluid."[1] Hunter thought coagulation a life action, as in union by the first intention particle unites with particle by cohesive attraction, for he says: "Union by the first intention is no more than the living parts separated—forming a reciprocal attraction of cohesion with the intermediate coagulum."[2]

[1] J. G. Millenmen: Curiosities of Medical Experience, p. 216.
[2] J. Hunter: A Treatise on the Blood, etc., p. 43.

The fluidity of the blood in the vessels was attributed to some unknown inherent principle. This coagulating lymph he considered the essential part of the blood, because it is to be found in all animals, and because, under certain circumstances, it is capable of "undergoing spontaneous changes, which are necessary to the growth, continuance and preservation of the animal."[3] The serum, he believed, common to the blood of all animals, but was most abundant in those which had red blood; it was lighter than other parts of the blood and the stronger the coagulation of the lymph the more serum could be obtained; it might be found without being separated from coagulating lymph, as in dropsy, and the fluid in which the fetus swims. The function of the serum he considered was to keep the red corpuscles suspended and prevent their solution; it also served to suspend or dissolve coloring matters and foreign substances, as is seen when the coloring matter of the bile is found in the blood in cases of jaundice or after the administration of rhubarb. He seems to have attached much importance to a "wheyish" appearance in the serum, which he observed most frequently "in the blood of breeding women" and which upon setting "often throws up a white scum like cream." In viewing this cream under the microscope it was "plainly globular." "The globules of white serum differ from the red globules in color, specific gravity, size and in not dissolving in water."[4] The red part of the blood he thought the least important; the red globules, he believed, had a determined shape and size and that they were regular so that two could not unite as could two drops of oil. He did not seem able to account for their peculiar properties, as he says: "What this property in the red part is I do not know, for it has something like the nature of a solid body; yet the particles seem not to have the properties of a solid, for to the touch they yield no feeling of solidity. When circulating in the vessels they may be seen to assume elliptical forms, adapting themselves to the size of the vessels; they must, therefore, be a fluid with an attraction to themselves while in the serum which forms them into round globules, yet without the power of uniting with one another, which may arise from their central attraction extending no further than own circumference."[5] As to their use, he says: "Whatever may be their utility in the machine, the red globules certainly are not of such universal use as the coagulating lymph. . . . . Their use would seem to be connected with strength."[6] The red globules, he thinks, give the color to the blood and the influence of air upon that color greatly interested him. "Many substances," he says, "change the color of the blood . . . . as the air produces this effect in the living body and as we find that without air the animal dies, great stress has been laid on this change of color, whereas it should only be considered as a sign that the blood has been in contact with the air, but not that it must be fit for the purpose of circulation. . . . . Most probably the effect of air upon the blood is greatest on the coagulating lymph; and this conjecture is rendered more likely when we consider that in animals which have no red globules of any kind respiration is as essential as in any other."[7] The blood, then, as Hunter knew it, consisted of three parts, the serum, the lightest; the lymph, or solid portion; and the red globules, the heaviest. A word in regard to his views of inflammation. The "act of inflammation," as he calls it, is attributed to increased action of the vessels, chiefly, if not altogether, in the smaller ones; these, when the stimulus causing the trouble is applied, are distended beyond their normal limits and size, this being an active dilatation, the blood has no change impressed upon it in passing through from the arteries to the veins; the increased redness was attributed not only to the fact that more blood reached the part by means of the dilated old vessels, but that new vessels were formed in the extravasated lymph. The swelling, he thought was due to extravasated lymph, the serum not being thrown out, as in dropsy, but squeezed out from the coagulating lymph. The pain was thought to be caused by increased nerve action brought about by the enlarged blood-vessels and the thrown-out lymph, the nerves themselves not being inflamed. Heat was regarded as a sign usually of strength and power of constitution and that it meant positive action, but the actual increase of the heat in inflammation he does not think as great as it seems to the senses; he says: "As inflammation is the principal instance capable of producing local heat I have taken the opportunity of examining inflammations . . . . I have also made several experiments . . . . and cannot say that I ever saw . . . . a case where the heat was really so much increased as it appeared to be to the sensations."[8] Magendie, in his lectures on the blood, delivered in 1837-1838, follows much in the line of Hunter's teachings; he speaks of fibrin and discusses the phenomena of coagulation. The red corpuscles he thought lost the ability to pass through the capillaries if modified in form or size. He treats in detail of a property of the blood, he terms it "viscousness," because by it the fluid is able to pass through the minutest capillaries which otherwise would be impossible. He uses as proof the experiment with water, which cannot be forced through the very minute vessels unless gum, gelatine or albumen are added "when the attempt at injection becomes successful immediately." He strongly disapproves of bleeding from points of election, the matter which gave rise to such a serious discussion as noted in the history. He says: "No one would have had hardihood enough to deny the excellent effects ascribed to bleeding practiced in those points of election, as they are called, while the theory which led to their adoption seemed so logically established. I confess I myself formerly shared in the belief professed by a majority of medical men on the point; but if you reflect on the matter, you will see that such a notion is utterly devoid of foundation. If the circulation were formed of a series of rings, mutually independent of each other, we might rationally open one vessel rather than another, according to the site of the disorder we had to com-

[3] Idem: p. 44.
[4] Idem: p. 62.
[5] Idem: p. 65.
[6] Idem: p. 72.
[7] Idem: p. 79.
[8] Idem: p. 323.

bat; but the chain formed by the arterial tubes is perfectly continuous throughout the frame. The pressure cannot diminish at one point without doing so to the same extent in every other. Whether you bleed from the temporal or the tibial artery, the effects will be mechanically the same in respect of the circulation of the brain. The preference given the former of these vessels is justified by its superficial position which renders it easily accessible; but as regards the therapeutical influence of its division, it can lay claim to no real superiority. If you represent by five the diminution of pressure in the temporal, you must represent by five also that in the tibial artery."[9] That his belief was not universal is seen where he says: "Further, it is a common inquiry, whether in cases of pneumonia of the right lung we should bleed at the right side; and in cases where the left organ is affected, at the left? Opinions are still divided on this point. . . . . But there is another method of blood-letting which is reserved for great and important occasions . . . . I mean cross-bleeding. . . . . Suppose a case in which a variety of therapeutical measures have proved unavailing. . . . . A consultation of medical celebrities is, of course, held and upon what do you suppose the deliberations sometimes turn? Upon the propriety of opening a vein in the right arm, at the same time as another in the left foot! Is there, I would ask, such a very great difference between the employment of amulets . . . . and the confidence attributed to bleedings the jets of which cross each other in the form of an X."[10]

The blood during the period, then, of ten years was regarded as a living fluid, composed of serum and red corpuscles; upon withdrawal from its vessels coagulation took place by the organization of fibrin, which formed the clot, this clot enmeshing the corpuscles and squeezing out the serum; the circulation of the blood in the minutest capillaries was made possible by the viscousness of that fluid and the fact that the corpuscles were able to conform themselves to the shape and size of the tubes, and lastly, although the belief was not universal, that the point of election was only one of convenience.

The changes induced in the healthy body by the withdrawal of blood were classified as primary and secondary, importance being attached not only to the quantity but to the rapidity of its withdrawal, six or eight ounces taken slowly producing no very striking effects, while 12 or 20 ounces taken rapidly would cause a feeling of languor, a weakening of the pulse, a pale, cold skin with cold sweat ending in syncope. Fainting was regarded as a very important indication, and Dr. Hall, in the review noted above, devotes a great deal of space to a discussion of the subject, as did most of the writers of that day. The review says: "It is certain that if several persons be bled deliquium in the erect posture, they being of apparently similar strength but affected with dissimilar diseases, they will be found to have lost very different quantities of blood before fainting is induced. Dr. Hall has known a patient, not apparently very feeble, to faint on losing four ounces of blood, while he has seen other patients bear the loss of 50, 60 or even 70 ounces of blood without syncope. How is this to be explained? Its rationale is to be found, I believe, in connection with an equally interesting fact, that different diseases induce" (in) "the constitution different powers or susceptibilities in regard to the effects of loss of blood. Each disease appears, indeed, to possess its own peculiar and intrinsic virtue in this respect. This is determined by placing the patient perfectly erect and bleeding to incipient syncope; the quantity of blood which flows is the measure of the protective influence of the disease in one class of cases, and of its influence in superintending a susceptibility to the effects of blood in the other.

"An interesting scale of diseases may be formed representing these properties. It would begin with congestion of the head or a tendency to apoplexy; inflammation of the serous membranes and of the parenchymatous substance of various organs would follow; and lastly, inflammation of the mucous membranes. This part of the scale would be divided from the next by the condition of the system in health. Below this would be arranged fever, the effects of intestinal irritation, some cases of delirium, reaction from loss of blood and disorders of the same class with hysteria, dyspepsia, chlorosis and cholera morbus." Again: "In inflammation much blood should be taken and much blood will flow before deliquium is induced; in irritation little blood should be drawn; and there is early syncope from blood-letting" (Balt. Month. J. M. & S., p. 208, etc.).

The immediate effects of blood-letting were believed to be caused by the rapidity of the withdrawal and the after effects by the quantity withdrawn. Nutrition was thought, in many cases, to be markedly improved, as when blood was carefully withdrawn the appetite improved as did also digestion and assimilation; small and frequent bleedings served to calm the circulation and this condition favored the deposition of fat; absorption from cavities and the interstices of the body was increased, hence the relief of dropsies and inflammatory exudates; the brain was thought to have its sensibilities to all kinds of impressions increased, while the power to act with effect and continuously was diminished, the mental powers were not thought to be impaired. It was considered "highly necessary to attend to the state of the mind and feelings of the patient" as "in persons of a timid disposition, the bare proposal of the operation of bleeding or even expectation of it, will sometimes occasion such general disorder of the system and in the pulse more especially, as may lead us to form an erroneous opinion as to the existing malady and its treatment."[11]

Blood-letting was used for a threefold purpose, as a curative, as a palliative and as a preventive. "In regard to its curative powers, blood-letting is capable of removing, with more or less facility, though never perhaps with absolute certainty, a great number of diseases, which but for its aid, would endanger or destroy life, and which cannot be effectually combated by other

[9] Magendie, F.: The Blood, p. 96.

[10] Idem: p. 97.

[11] H. Clutterbuck: Lectures on Blood-letting, p. 25.

means. Considered in the light of a palliative merely, it is still of no small value . . . . there are scarcely any that do not admit of more or less palliation; and blood-letting is often the best means we have of effecting this purpose. An instance of this is afforded in the case of phthisis pulmonalis, where the acute pain that occasionally arises in the chest, even in an advanced stage of the disease, and when the case is altogether hopeless, seldom fails to be relieved by a small bleeding; and (provided this be done under proper limitation) without any increase of weakness, or other inconvenience. On the contrary, not only is the pain relieved, but the hectic and night sweats also; while the appetite is usually improved by it, and sleep rendered more refreshing. The same remedy is also, on many occasions, preventive in its effects; by lessening if not destroying the tendency to certain diseases, of which apoplexy, hemorrhage and inflammation may be cited as examples sufficiently well known."[12] It was believed to be capable at times of controlling spasm, to act as an anodyne in the relief of pain and as a narcotic inducing tranquil sleep. It was used to influence disease in one or more of the following ways: by merely reducing the mass of blood, by a general weakening of the system and as a sedative by diminishing vascular activity and excitement. The first was used to overcome that factor which was thought to hold such a very important position in the cause of disease, regardless of its nature, namely *plethora;* the second to overcome what was known as the *sthenic* condition, which was thought to call for a weakening of the system, and in cases of fever and vascular excitement blood was drawn for its sedative effect.

Blood was obtained in one of four ways and much discussion was indulged in in regard to their relative values; phlebotomy or the opening of a vein, arteriotomy or the opening of an artery, scarification, either with or without cupping, and by the use of leeches. Phlebotomy and arteriotomy constituted what was known as general, and scarification and leeches what was known as local or topical bleeding; the former was supposed to produce its remedial effect "either by sympathy or through the medium of the general system" and in the latter "the blood is taken, or presumed to be taken, immediately from the vessels of the diseased part or those in its immediate vicinity." Two conditions were chiefly relied upon in determining how and in what quantity blood should be taken, the strength or weakness of the patient and the condition of the pulse. Dr. Clutterbuck concludes a very interesting discussion of the pulse as a determining factor in blood-letting as follows: "There is, nevertheless, a state of pulse that is always extremely unfavorable to blood-letting, if not altogether prohibitory of it: I mean, where it is at once small, soft and compressible by the slightest force. But this is sure to be accompanied by other unequivocal signs of extreme weakness that cannot well be mistaken.

"Upon the whole, I may observe, that there is hardly any condition of pulse, either in regard to strength or weakness, fullness or smallness, hardness or softness, frequency or slowness, regularity or irregularity, which taken singly and in all cases, either absolutely calls for, or prohibits, blood-letting. Much attention, doubtless, is due to all of them. Each may serve as a guide, in regard to the quantity of blood to be drawn, the repetition of the operation and the like; while, taken in conjunction with other circumstances, it may serve to determine the propriety of the evacuation altogether."

The questions to be answered in each case, after a bleeding was decided upon, was how much and in what manner the blood should be taken. Much discussion took place as to whether there should be one large bleeding or several small ones, and the celebrities of that day were frequently called in consultation to determine the point.

In adults of good general health, from 8 to 12 ounces was considered a moderate and 16 to 20 ounces a large bleeding. The large bleedings were, as a rule, resorted to in the acute and violent types of disease and the smaller in those types of a more chronic character.

Dr. Rush, of Philadelphia, says that 90 ounces were taken at one time from his friend, Dr. Dewees, and with advantage. The latter physician, Dr. Dewees, himself states that he took 80 ounces of blood within a few hours from a young and delicate woman, who had been seized with convulsions towards the end of pregnancy; and from another similarly affected, at the commencement of labor, he drew 120 ounces within five or six hours, and 20 more the following day. The patient, notwithstanding, he says, recovered rapidly, but became blind and continued so for a fortnight and did not perfectly recover her sight for six months"[13] "Dr. Barlow . . . . mentions the case of a feeble and emaciated boy, who was laboring under diabetes, and from whom 209 ounces (13 pounds) were taken at 12 successive bleedings, in the space of 51 days, which is at the rate of 19 ounces each bleeding; he was bled twice a week on the average. The effect, Dr. B. says, was striking; from a state of feebleness, hardly admitting of an erect posture, the lad acquired a degree of vigor which enabled him to hold the plough for several hours a day."[14]

Blood-letting, above all, was used in that strange series of phenomena which grouped together were called inflammation. Dr. Clutterbuck says, p. 60: "Among the diseases to which blood-letting is particularly adapted inflammation undoubtedly claims the first place, for it is here that the power of the remedy is most strikingly displayed, and its employment the most frequently called for." Again, p. 65, he says: "Different circumstances appear to influence the result, in the application of blood-letting as a remedy for inflammation, and which, therefore, require to be considered. The following are the chief:

"1. The degree of the disease.

"2. The stage of it.

"3. The part in which it is seated.

"4. The nature of the inflammation itself."

Hemorrhages of the so-called active type were treated to a very large extent by blood-letting, as were also dropsies. Many

[12] Idem: p. 27.

[13] Idem: p. 51.

[14] Idem: p. 52.

forms of cerebral disease were thought to be very favorably influenced by the drawing of blood, notably apoplexy.

This imperfect sketch may be fittingly concluded by a quotation from Dr. Clutterbuck; he says, p. 36: "There is no one function, either mental or bodily, that is not more or less under the immediate influence of this agent, according to the manner in which it is applied, and the extent to which it is carried. It quickly and powerfully disturbs the heart and whole vascular system; as is evident not only from the changes induced on the pulse but from the capillaries, in extreme cases, suddenly ceasing to contract, so as to allow their contents to escape in the form of cold sweats; respiration is disordered by it—the alimentary canal and urinary organs often discharge their contents involuntarily—and lastly, the cerebral functions of sensation, voluntary motion and thought, are impaired, disordered or even wholly suspended, by a sudden and copious abstraction of blood. Nor are morbid actions by any means exempt from this influence (for disease is only a modification of healthy action, and is more or less under the influence of the same agents). In short, blood-letting, in checking or suppressing violent diseases of any kind, appears to act upon a principle very analogous, if not identical with, what is called counter-irritation, but which in this case is, perhaps, better termed counter-impression."

THE IMPORTANCE OF A THOROUGH TEACHING OF INFECTIOUS DISEASES OF CHILDHOOD IN THE MEDICAL CURRICULUM.

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The average student leaves our medical schools without having seen many of the infectious diseases of childhood. When entering on his practice, his ignorance contrasts sadly with the knowledge of mothers and grandmothers gained by experience.

Several reasons may be assigned for this apparent neglect of a thorough instruction of our medical students in these diseases. A large number of medical schools have no hospitals of their own in which the teaching could be carried on in a way satisfactory to the faculty. Those medical schools which are more intimately connected with well equipped hospitals labor under the disadvantage that these hospitals do not admit cases of infectious diseases. One of the most prominent reasons for such a policy is the expense, which is necessarily caused by the proper care of these cases. The most important consideration which confronts those in charge of the hospitals is, not to expose the other patients to the danger of infection. This can only be accomplished by having a number of rooms at disposal where suspicious cases can be watched, and special wards where positive cases can be kept without danger to other patients. The proper construction of such wards insuring the necessary isolation of the patients with the increased demands for cleaning and disinfecting, exceeds the means of most of our institutions. Aside from the separate construction, the service is necessarily connected with great expense. It requires a special set of nurses, and the staff of nurses must be kept up even with a relatively small number of patients. Not only the patients suffering with various infectious diseases must be kept apart, but the nurses of the different wards cannot be interchanged. For instance, a ward where scarlet fever patients are kept may be filled, and this necessitates an addition to the staff of nurses, while in the ward for diphtheria there may be only one or two patients, but the nurses assigned to the diphtheria ward cannot be called to service in the scarlet fever ward.

For these reasons mainly, the medical schools lack the necessary material, under their own control, for teaching. This lack could be supplied in certain communities by utilizing the special hospitals for infectious diseases, which are usually city institutions. Sometimes the rivalry between the medical schools in a given community prevents the proper utilization of these opportunities; sometimes these hospitals are rather far distant from the centers of medical learning and this creates new difficulties.

Many communities insist that a hospital for infectious diseases ought to be removed beyond the boundary line of the city. This is certainly just for those infectious diseases which do not occur regularly in the community, for instance sporadic cases of certain infectious diseases introduced from outside. This requirement is absolutely justified in cases of plague, cholera, small-pox, etc., but there is absolutely no necessity, and we may perhaps say that it is not reasonable to adopt blindly such strict rules for infectious diseases which occur constantly in our own midst, where in the majority of cases many foci of infection still remain within the city limits, for a certain number of cases are taken care of at home, light cases are frequently not recognized, and in many instances the infection is spread far and wide before the label is put on the door.

In fact, we have to distinguish accurately these two kinds of infectious diseases: sporadic infections from outside which can be kept from the community by a rigid legislation, and endemic diseases in which the scope of the legislation is only to take care of the individuals, and to avoid further infections as much as possible under given conditions. For the first kind of diseases the utmost strictness should be applied. For instance when a case of plague is reported, not only the patient himself must be taken to an absolutely isolated hospital, but also all persons who are likely to have become infected by him should be kept under observation for a certain time. On the other hand, chicken-pox, for instance, is such a generally spread and at the same time mild infection, that it is a waste

of money to apply any elaborate hygienic measures to treat the comparatively few cases which are brought to the notice of the health authorities. Now between these two extremes, every other infectious disease must be considered individually, depending on its gravity, its infectivity, and the fact whether at the place in question it is endemic or sporadic. Let us suppose, for instance, an island to which measles is brought only every twenty or thirty years. Here a case of measles should be treated under the strict rules given for an outside infection which can be controlled. On the American and European continent, however, any attempt to really control measles is a futile one, since thousands of foci always exist.

It is very interesting, nevertheless, to think that just in measles it would be possible to get rid of the disease entirely within three weeks if at some time the whole earth should be under exact hygienic regulations. Suppose in all countries such hygienic measures would be possible as is the case in the most civilized ones, and for only three weeks every patient with measles could be kept apart from those persons who did not yet have the disease, we would get rid of it with one stroke, as there is no probability that germs of measles can be transmitted to animals, and as they do not stand drying. Every infection is given from man to man, and the infectivity of the cases lasts a very short time, probably only about a week after the outbreak of the rash. So, if for three weeks no new medium was offered to the germs, they would necessarily die out. But this is a dream of the future.

I started to say that the same hygienic rules are not to be applied in all infectious diseases, and that it is not objectionable at all to have wards for the common endemic diseases within city limits, for the purpose of teaching and also for the reason that parents are nearer to their children. The necessary consequence of an infectious hospital outside of city limits is that parents do not like to give up their children, and therefore conceal an infection as long as possible. In mild cases this can easily be done by not calling a doctor, and then just the opposite of the hygienic measure intended is a practical result of it, *i. e.*, that no attention whatever is given to the spreading of the disease. This idea of not allowing any infection within city limits reminds me of a city in Russia, where the council wished to build a sewerage system. All the proprietors of the houses where the canal was to be built objected to being in the immediate neighborhood of the system on account of the bad odor, which they supposed would be a necessary consequence. But the material is in town, and how can it be carried out without a canal? That is not our affair they answered, the only thing we say is that we will not allow anything called a canal to pass our houses.

That is not so different from our subject as it seems at first sight. The infectious diseases are endemic in town, we cannot deny that; every street contains foci, and if we include tuberculosis among the infectious diseases, we may say that every house contains infectious agents. The sewerage of infections of that kind must be made so easy, that people in their own interest shall prefer to use it. If we force every infection, which is declared to be one, far out of town, if we do not allow the parents to visit their children there, the natural consequence is that the parents will use that hospital as little as possible, and that, if they know that a doctor applies all hygienic measures, they will simply not call the doctor, but help themselves in another way, dangerous not only for the patient but for the neighborhood. I can give you examples from Vienna, where infectious wards are connected with each of the children's hospitals, and there are in addition, two large hospitals for contagious diseases outside the limits of the city. The parents come very often to ask whether there is a place in one of the town hospitals; if there is not, they object to having their children taken to the out-of-town hospitals, as they are so far away that a visit there is difficult and furthermore costs the parents a half-day's salary. There is besides another disadvantage in cases of diphtheritic croup. Every year cases of death from suffocation occur, caused by the delay in carrying the children from their homes or from the out-patient department of another hospital to the very remote infectious hospitals.

As to the danger of a hospital for these common infections being within the city limits, there is none at all for the neighbors, if care is taken, and I do not remember any case of infection of a child due simply to the neighborhood of these wards. Every out-patient department is far more dangerous, where children wait together before they are classified, and in every car where children ride together to a hospital, there is more likelihood of an infection, than in the surroundings of a closed building containing carefully watched cases of infectious diseases.

In those cities where infectious hospitals have been established lately within city limits, the effect on the number of infections and on their gravity has made itself felt strikingly by the diminution of these diseases. I have been told of Boston that the health authorities there are extremely satisfied with the results of that system.

In New York also the system of in-town infectious hospitals works very well; and Dr. Biggs told me lately, that they have even allowed the parents to go in the wards to visit their children under certain hygienic precautions. This is also done with the idea of making it as easy as possible for the public to use the infectious hospitals. The result is that an ever increasing percentage of cases are sent there, that they are treated better, and moreover that they do not infect others.

The ideal condition would be to have all of the cases of certain infections treated in hospitals, namely, scarlet fever, diphtheria and whooping cough. The reason for scarlet fever is that the germs are extremely stable, and that in an ordinary room of a private house where a scarlet fever patient has scaled for several weeks, one can hardly make a perfect disinfection. There are cases reported of children who apparently got scarlet fever in a certain room of a house at intervals of many months.

The contamination may be on other objects which at home are not always really disinfected. I saw the following instance: a girl of four years died of scarlet fever; the clothes were disinfected, with the exception of a little fur coat and

fur cap which were not delivered to the disinfector by the mother, as she feared that they would be damaged. She kept them in a box in the house, and took them out only after two years when the next girl was old enough to wear them. Four days afterward the girl became ill with scarlet fever. Therefore, we should send scarlet fever patients to hospitals to prevent the infection of rooms and objects.

In diphtheria it should be done as there is always a possibility that laryngeal symptoms may develop. Every case which does not come very early under the doctor's care and where no anti-toxin injection has been made at once is better off in a hospital under constant observation.

As to whooping cough, only extensive hospital accommodation will allow us to master this dreadful enemy of childhood. At home we cannot keep the children in the room for such a long time: they go out on the street, to the parks, and always infect others. Large wards should be constructed for these children, it would be well to send the convalescents to a farm.

So, hospital treatment is wanted for the sake of the public in scarlet fever and whooping cough on account of their infectiousness; in diphtheria on account of its immediate danger and sequelæ for the child.

We must look in quite another way at measles, German measles and chicken-pox. Chicken-pox is a milder infection than an ordinary coryza, and it is practically not worth while to adopt any isolation measures; the same is true for German measles. In measles hospital treatment gives, on the whole, worse results than treatment at home, due to the secondary infections which are apt to follow. If in a hospital the accommodations are not very extensive, the children with measles easily get secondary broncho-pneumonia and other infections in the ward, especially influenza or diphtheria, if one of the other children in the ward happens to have it. The statistics show better results in the cases treated at home.

Here two reasons may be given for hospital treatment of these diseases; first, the necessity of caring for those cases which cannot have the proper treatment at home; and, second, the necessity of studying those diseases and of instructing students in them. For these purposes cases of stomatitis, aphthæ, Vincent's angina, etc. would also be accepted. These diseases do not require an entire ward to themselves, but merely cubicles separated by glass partitions according to the French system, with of course a careful, separate service sufficient to avoid spreading of the infection.

The infectious disease of childhood which has the most severe consequences for a lifetime is certainly tuberculosis. We know that most of us are infected during childhood, and probably the pulmonary tuberculosis of adults is only a recrudescence of the early process, comparable to the third state of syphilis. Only about seven per cent of the tubercular infections are fatal. It is quite wrong to close our eyes to the truth, as for instance with the sewerage example, and to declare only those people tuberculous who after some examination are so labelled. It is of the utmost importance to make it as easy as possible for the carrier of lung foci, who spits and coughs tubercle bacilli, to be received in wards within the city limits, but under hygienic conditions, and thus prevent their spreading the disease by reckless spitting. This question has been referred to lately so many times that I will not delay over it, but only say that it is extremely necessary that special wards for tuberculosis should be attached to teaching hospitals, and that every means should be taken to exterminate the disease wherever it is found.

But now some one will say is it at all worth while to fight the common infectious diseases? Isn't it simply a matter of chance whether a child will get it or not, and isn't it even better for the child to have it early? Many people have an idea with regard to infections somewhat related to the theories of the old Indian brahmins on small-pox. These old colleagues thought that every man had in himself small-pox stuff, and that the infection consisted only in the act of setting that stuff on fire. It was best for the stuff to be lighted at a given age and under good hygienic conditions, so that the necessary blaze should not create too much trouble in the organism. This was the idea which led to small-pox inoculation, the method of which is preserved in our vaccination. With vaccination we let every individual pass through a mild form of the disease. Is this not ideal for all the infections? No, as on one hand we are not yet far enough advanced to vaccinate against every infection, and on the other hand it would not even be practical for all of them. In this respect also we must individualize entirely according to the diseases. There are only a few maladies which are so infectious for all ages that the probability of becoming infected sooner or later reaches about 90 per cent. This was the case with small-pox in former centuries and is nowadays the case with measles. These are diseases for which the disposition does not change during life. In the Fiji Islands, for instance, where a measles infection entered in 1875, after the last epidemic had occurred in 1846, practically every person became infected, the old people excepted who were immune from the first epidemic thirty-nine years earlier. In America and Europe the possibility of becoming infected is such that we cannot protect children absolutely from measles, for they will become infected sooner or later, and all we can hope for is that the whole family may chance to get it at one time when the hygienic conditions are favorable.

But quite different are the conditions in scarlet fever and whooping cough. Here the disposition diminishes in later years of childhood. Scarlet fever does not attack a great percentage of people, and the immunity of later life consists not only in a personally acquired one, as is the case in measles, but the disposition decreases with age. Here we should make every effort to avoid infection, for as the child grows older, the probability of its getting the disease becomes less. The conditions in whooping cough are similar, and especially chicken-pox, which is hardly infectious for adults.

A third group of infectious diseases leaves no immunity, and, therefore, an infection in childhood does not eliminate the chance of a later attack. This is the case in erysipelas and in diphtheria. But in diphtheria the general disposition diminishes as one grows older, and especially the disposition

for the laryngeal form. So, if possible, it is wise to avoid exposing children to this disease.

The hygienic measures which the Board of Health enforces on the family of the patient should be varied in accordance with the different diseases; for instance it is not justifiable to restrict the movements of the inmates of a house harboring a case of measles, and the necessity of disinfecting the rooms where such a patient has been kept is much less important than the disinfection of a room of a scarlet fever patient.

As to the *teaching of infectious diseases*, we must again make the separation of the two main groups. To the one belongs the sporadic infections not endemic in a community; to the other, the common infectious diseases. With regard to the first group a thorough knowledge of the diseases no doubt is desirable but practically impossible, as the student never will see many, if any, cases of these rarer infections. The student must be taught the principal features of such diseases, and he must be impressed with the fact that his knowledge of these diseases is by necessity deficient.

But what we must demand from the practitioner is that he be well enough acquainted with the usual infectious diseases, so that if he sees a case of one of the rarer infectious diseases, if he happens to meet it in his practice, he may recognize that it shows some features which do not belong to the common infectious diseases and know that the patient should be at once isolated; for instance it cannot be expected that the average practitioner should recognize immediately a case of small-pox at its onset, but it should not happen—as has occurred lately—that a case of small-pox is mistaken first for a case of measles, then after the lapse of a few days for one of chicken-pox. It the practitioner is confronted with an unfamiliar exanthematous disease, he should know enough not to be ashamed of his limits of knowledge, and call to his aid the proper health officer, of whom we presuppose a thorough training in all infectious diseases. If the training of the practitioner has been proper, he will not hesitate to avail himself of such an opportunity.

With regard to the teaching of the common infectious diseases, it is not sufficient to have read the text-books or to have seen as many cases as even a man with a large practice may see. The infinite variety of the manifestations practically precludes the possibility of seeing enough of these cases in a practice ever so large. If we expect a thorough training of our students within a relatively short time, we must demand from the teachers of this subject a further knowledge than text-book and private practice can supply. Only a special training in infectious hospitals can give the teacher sufficient experience to instruct the student properly.

Naturally with the time allotted for the study of our subject, it will never be possible to show the student all the varieties of the different diseases, but having had a proper training himself, the teacher will be capable of insisting on the most essential features and the occurrence of certain so-called abnormalities in the course of the disease, and of calling attention to others which may occur. We need not dilate on the fact that the course of the infectious diseases is just as frequently atypical as typical. It is of great importance that the student should follow the cases from beginning to end, so that he may learn to distinguish rapidly the different phases in which a case may be presented to him. At the same time it is only in this way that it is possible for him to study the effect of therapeutic measures, and the results which he may expect from them.

One of the most frequent questions which will be asked in medical practice is, how long will the disease last, and what will be the probable outcome? It is impossible to gain enough information about the different phases and possibilities of the diseases by the uncertain observations in a dispensary, and while we all know that the practice must fill out many a gap in our medical school education, it would be very desirable not to leave too big a gap in a field of such importance. Whereas therapy can be learned more or less from books, the decision whether a case is dangerous or not rests upon personal experience.

The *teaching of diphtheria* will have to do first with a quick and sure diagnosis. The first symptoms here often arise so slowly and with only general indisposition, that a doctor who is not accumtomed, on principle, always to look in the throat of the child, easily overlooks the first stages. The student must be taught to look in the throat of the child, because this is not so easy a matter, especially in private practice, and sometimes one is compelled to use various tricks. Then it requires a certain experience to see at a glance the slight gray spots on the back wall of the throat for example, which are so characteristic of diphtheria; one must become accustomed to the importance and nearly decisive meaning of a simultaneous hoarseness and angina, and of a discharge from the nose due to diphtheritic infection.

Besides the diagnosis by sight, the student must become familiar with the aid the laboratory lends to the diagnosis. If a case shows a gray membrane, or a combination of angina with hoarseness, or one has some other reason for making a clinical diagnosis of diphtheria, one should never wait for the result of a bacteriological examination, but inject the serum; only in slight and doubtful cases one may wait with the treatment. Before reporting a case as one of diphtheria we may wait until the diagnosis is more firmly established in order not to cause trouble when one is not absolutely sure that the case is really one of diphtheria. The technique of serum injections must be taught furthermore, and the rashes due to horse serum, so that they may not be mistaken for scarlet fever or some other complication. The immediate anaphylactic phenomema which may occur if a patient is injected a second time with horse serum must be also familiar to the student.

Very important is the treatment of croup. We first use in every case the ingenious discovery of O'Dwyer, the intubation; only if that fails, because the membranes extend down too far, do we try a tracheotomy. Intubation should be taught to every student, either by means of the cadaver or of models. It is an easy and quick operation for the man who has learned

it, but it is difficult to perform for the first time in an urgent case in the moment of suffocation.

The sequelæ in diphtheria must be known: the danger of heart weakness, the symptoms of it, the comparatively unimportant albuminuria, and the many kinds of nervous and muscular troubles during convalescence.

In *scarlet fever* the diagnosis of the exanthem is a thing which we never can learn absolutely. Typical cases are easily recognized, but there are so many forms that only a good experience gives some degree of certainty. How many cases of mild rashes are considered as exanthemata due to heat and neglected, and three weeks later the kidney trouble sets in! And how much harm is done if only the throat is inspected and not the body! As to the prognosis, we shall have to tell the student that every mental trouble or delirium, for instance, bodes ill in scarlet fever, and that the temperature is intimately connected with the intensity of the case; whereas in diphtheria the height of the temperature means nothing, as the worst cases may show a subnormal temperature.

In *measles*, again, the temperature is always a very high one; it means nothing as long as it precedes the outbreak; if it does not disappear, however, three days after the beginning of the rash, we know that some secondary infection has occurred, and we should make a very careful examination of chest, throat, nose and ears. Here the students need not only be taught the exanthem in its various forms, but especially the very characteristic symptom of the mucous membrane of the mouth which we owe to Koplik, enabling us to form an absolutely certain diagnosis generally two days before the exanthem—two days before the mother and grandmother make their diagnosis. The connection of measles with tuberculosis is of great interest.

In *chicken-pox* we must make the differential diagnosis from impetigo on one hand and from small-pox on the other.

In *tuberculosis of childhood*, all the various and numerous forms must be watched and the modern methods of diagnosis be taught. Then only do we see what an enormous part this disease plays among the anemias, skin diseases, and eye diseases of childhood. The first signs of a miliary tuberculosis especially should be noticed, and the picture of a beginning meningitis impressed on the student; for this is a disease where a wrong diagnosis is often held as a long lasting reproach against the doctor by the parents. The practice of lumbar puncture is necessary both for tubercular and *epidemic meningitis;* and here we should also teach the intraspinal injection of Flexner's serum. An exact differential diagnosis between the main kinds of meningitis is extremely necessary for the prognosis and for the therapy.

Finally, very easily taught and extremely important for the conception and clinical understanding of infectious diseases, is the *cowpox vaccination*. Here we produce a real infection on the skin and see its whole development, see the influence on the general system, and can study the effects of immunity in watching carefully the results of a second vaccination. This simple operation should not only be taught as a matter of routine, but as a deep and interesting experimental study of the forces of the organism against the microbe.

To sum up, we reach the conclusion that the medical student should get a good training in the ordinary infectious diseases of childhood, in order to make the diagnosis with certainty, even in somewhat atypical cases, in order to apply the right therapy, to be able to make a prognosis, and in order to take prophylactic measures necessary in the case of special disease; finally, in order to recognize a case of an unusual infection which may mean a real danger for the community.

For this purpose it is not sufficient for the student to get a theoretical course or to see a case in a dispensary now and then, but the student should be taught by the bedside and by a teacher who has himself a thorough training in infectious diseases. To this effect, wards for the common endemic infections should be attached to the hospitals of the medical schools. This is not only not objectionable from the hygienic point of view, but has many advantages. A certain number of hours of bedside instruction in infectious diseases should be inserted as a necessary course in the medical curriculum in the third or fourth year.

I hope that the audience will endorse the importance of these demands, and that the American Medical Association will take up the matter and bring it to the general consideration of the profession.

NOTES ON NEW BOOKS.

St. Louis. Its History and Ideals. Prepared for the Sixty-first Annual Session of the American Medical Association by Philip Shrainka, M. D. (*St. Louis, 1910.*)

An excellent guide to the city, well illustrated, and serviceable for all visitors.

La tension artérielle en clinique, sa valeur séméiologique. By Dr. Louis Gallaverdin, Medecin des hôpitaux de Lyon. (*Paris: G. Steinheil, 1910.*) 206 pp. 69 figures.

This little book deals only with clinical hydrodynamics, the technique of the various clinical methods of sphygmomanometry and the principles on which their use is based. In this respect, in text, figures and bibliography it carries out very well the intentions of the author and furnishes interesting and profitable reading to any one who desires to become thoroughly acquainted with clinical hæmodynamics. Unlike many books written upon the continent, the English and American literatures are discussed along with the French, German and Italian. The conditions in which disturbances in arterial blood pressure occur and the discussion of venous pressure do not fall within the scope of the book.

American Practice of Surgery. Editors: Joseph D. Bryant, M. D., LL. D., Albert H. Buck, M. D., of New York City. Complete in eight volumes. Profusely illustrated. Volume seven. (*New York: William Wood and Company, 1910.*)

With the exception of one chapter on the Surgery of the Pericardium, Heart, and Blood-Vessels and one on Surgical Diseases of the Extremities, this volume of over 950 pages is devoted to the

affections of the abdomen and pelvis. The surgical diseases and wounds of the œsophagus are treated with those of the stomach. The sixteen chapters have been written by sixteen authors—surgeons widely scattered through the United States, so that the work is really representative of "American Practice." A general country surgeon must necessarily have some such work on his book shelves, and whether he buys this system or the one lately edited by Keen will depend almost entirely on his personal preference and opportunity to compare the two. Both will prove of service to him, and with either he should be well contented. They, neither of them, can replace well-written monographs, or volumes devoted to special regional surgery, but for those he will probably have less call than for the larger systems, burdensome as they are, by their size. With this "Practice" at hand a surgeon should seldom be in doubt as to a safe method to pursue in a given case, but no book will serve him in every instance, and he must be ready to use his common sense in emergencies, which after all is his most serviceable tool, when he is once grounded in the principles of surgery.

Diseases of the Stomach and Intestines. By ROBERT COLEMAN KEMP, M. D., Professor of Gastro-intestinal Diseases, New York School of Clinical Medicine. Octavo. Illustrated. Cloth, $6.00. (*Philadelphia and London: W. B. Saunders Company, 1910.*)

This book as the author states in his preface is designed to present simple and practical methods to the general practitioners and this it does very well.

The anatomy and physiology of the stomach and intestines are first considered and the general methods of physical examination detailed with chapters on the X-ray and transillumination of the stomach, the use of various test meals, etc. Diet and therapy, with the use of electricity massage and hydrotherapy are fully dealt with.

The various diseases of the stomach are next taken up in detail and the functions of the stomach in diseases of the organs dealt upon.

Diseases of the intestines follow in the last half of the book and methods of examination detailed; among the diseases considered, there are special chapters on dysentery, typhoid fever, appendicitis, diverticulitis and intestinal parasites.

The book as a whole seems to accomplish very well certain of the author's ideas expressed in the preface, but at times strives to accomplish too much in a small space. The practical side of the subject is, however, well borne in mind throughout and the illustrations quite good (except for the tendency so prevalent at present of using *female models* to illustrate either unimportant points, or points that at least could be much more clearly and accurately shown on a diagrammatic figure).

Urgent Surgery. By FELIX LEJARS, Professor Agrégé à la Faculté de Médecine de Paris, Chirurgien de l'Hôpital Saint-Antoine, Membre de la Société de Chirurgie. Translated from the sixth edition by WILLIAM S. DICKIE, F. R. C. S., etc. With 20 full-page plates and 994 illustrations, of which 602 are drawn by DR. DALOINE and A. LEUBA, and 217 are from original photographs. Vol. 1. (*New York: William Wood and Company, 1910.*)

The author says Urgent Surgery does not mean merely the surgery of injuries, but also includes the numerous clinical conditions which demand immediate surgical action.

He thinks that those who are not operators themselves should at least know something of the details of the operation. Also that there are certain things which every practitioner should be able to do, and which he cannot avoid without dereliction of duty.

He says that in this book there are no theoretical discussions or descriptions of untried methods.

Urgent operations and procedures are taken up and are described as the author has found it most expedient in his experience.

There have been 6 French editions in ten years and the work has been translated into German, Spanish, Italian, Hungarian, Russian and Japanese, which shows its popularity.

This volume is divided into six sections, as follows: I. Introductory; II. The Head; III. The Neck; IV. The Thorax; V. The Spine; VI. The Abdomen. The book shows the operative methods of a French surgeon in treating lesions which are of the greatest interest to every general surgeon.

The translation has been especially well done, and the volume has lost nothing of its effectiveness in the hands of the translator. The book is well gotten up, the illustrations are good.

While it is doubtful whether the general practitioner should ever operate for most of the conditions described, nevertheless a careful study of this work will be of great advantage to the practitioner, but more especially to the practical operating surgeon.

J. S. D.

Bulletin of the Warren Anatomical Museum. Harvard Medical School. No. 1, Pathological Anatomy—Bones, Joints, Synovial Membranes, Tendons. (*Boston, Mass., 1910.*)

Dr. William F. Whitney, the curator of the museum, has prepared admirably this first Bulletin to be followed by others, and which will perfect little by little the original catalogue first published many years ago. There can be no doubt that if these Bulletins can be freely illustrated they will prove serviceable to many men and in many ways. This number contains some excellent reproductions, and is of special interest to the orthopedic surgeon. It is not intended to catalogue every specimen but to issue Bulletins of different parts of the collection. The contents of No. 1 include under the heading of bones, specimens of osteomyelitis, tuberculosis, scoliosis, club-foot, etc.; and under joints, specimens of spondylitis, and arthritis deformans, and gout; under synovial membranes, simply joints and bursæ are mentioned.

Department of Commerce and Labor. Bureau of the Census. C. DANA DURAND, Director. Mortality Statistics, 1908. Ninth Annual Report. (*Washington: Government Printing Office, 1910.*)

The value of these reports increases annually from the larger figures which are dealt with and the greater elaboration in the preparation of the tables. Since the last report two new states are now included among the registration states so that just over one-half the total estimated population is now represented, and when the next report is issued a still larger proportion of the population will be represented. The "Introduction" by the Director is full of interest to all those working for the national welfare. Not only statisticians but doctors should read it carefully, and to all Boards of Health the statistics are of the utmost importance. The Director has carefully analyzed the mortality figures from the leading causes of death, and his "Introduction" is not "dry," even though dealing largely in numbers, but on the contrary is so full of thought and information, that its careful study is repaying.

Medical Electricity and Roentgen Rays with Chapters on Phototherapy and Radium. By SINCLAIR TOUSEY, A. M., M. D. (*Philadelphia: W. B. Saunders & Co., 1910.*)

In a new branch of medicine and one which is developing so rapidly and along so many lines it is a difficult proposition to present the subject in a systematic way. The author, however, has succeeded remarkably well in giving us a clear and concise presentation of the subject. The book is divided into three sections, namely Medical Electricity, Radiography and Radiotherapy, and Radium.

Two-thirds of the book is given over to Medical Electricity. It gives the elementary principles, the mechanism and the methods to obtain the best results. Possibly the author may be somewhat

over-enthusiastic in his claims for the therapeutic effects of electricity in certain diseases, yet as a whole he has been quite conservative.

The section on Radiography and Radiotherapy is excellent. The author is especially to be commended for his advocacy of the fluoroscope. Fluoroscopy, especially in this country, has been much neglected in recent years on account of the fear of dermatitis to the operator. With proper care this can be avoided. A thorough examination of the chest is incomplete unless fluoroscopy is employed. It is the only means whereby we can see the viscera in motion. To see the definite limitation of motion of the diaphragm or the clavicles in pulmonary tuberculosis, when the lower or upper lobes are involved, will convince one immediately of the value of this method. The author has emphasized this point.

In the section on Radium the chemical and physiological effects are given and theory of radioactivity. Then we have a short account of the pathological and the therapeutic uses. This section is naturally brief as the high cost and scarcity of radium has limited its use to but a few experimentors and consequently the data is necessarily small.

Preparatory and After Treatment in Operative Cases. By HERMAN A. HAUBOLD, M. D. With 429 illustrations. (*New York and London: D. Appleton and Company, 1910.*)

The book is divided into 34 chapters, the first 15 of which consider sterilization, materials, etc., and the general subject of preparatory and after treatment. In the remaining chapters the preparatory and after treatment of operations on the different regions of the body are taken up.

The book is clearly written and is well gotten up. A number of authors are mentioned and quotations from their papers are used, but very few of the original references are given. The illustrations are good but considerably more than half of them are taken from other articles or from instrument catalogues.

It is the desire of the author to furnish "a work from which the practitioner can draw information with regard to the handling of a case to be operated upon from the time the decision to operate is reached up to the making of the incision, and then take up the case again from the time the operative technic is ended until recovery is complete."

The volume accomplishes this object, and will be of more use to the practitioner than to the surgeon. J. S. D.

Myomata of the Uterus. By HOWARD A. KELLY and THOMAS S. CULLEN. Illustrated by AUGUST HORN and HERMANN BECKER. Price, $7.50. (*Philadelphia: W. B. Saunders Company, 1909.*)

The authors present in attractive form an exhaustive clinical and pathological study of 1674 personal cases of uterine myomata, observed, studied and treated in the Gynecological Clinic of the Johns Hopkins Hospital and in their private practices. The autopsy material at the Johns Hopkins Hospital has been utilized in the chapters on the frequency of myomata and on their association with pathological conditions in other organs. Including its index the volume contains 723 pages. There are 388 illustrations.

The highest praise should be accorded the publishers for the way they have printed the text and reproduced the superb drawings of Messrs. Horn and Becker. The paper is thick, the print large and clear and the illustrations unusually plastic, an affect attained by a brown ink which, so far as is known to the reviewer, has never before been employed for the illustrations of a medical work.

The book is divided into 35 chapters, the titles of which afford an insight into both the matter treated and the method of treatment. In Chapter I, "Uterine Myomata," their site, number, size, shape, blood supply, histogenesis, relation to the body of the uterus and condition of the myometrium are considered. To Chapter II, "Parasitic Uterine Myomata," nearly forty pages is devoted. It is clear, complete, new and beautifully illustrated. Chapter III fully deals with "Cervical Myomata" and the illustrations are fine. Chapter IV discusses "Submucous Myomata" and especially those undergoing necrotic change and sloughing. Chapter V, "Dilatation of the Uterine Lymphatics Associated with Myomata," brings to the reader's attention in clear and graphic form a condition not generally appreciated. Chapter VI, "Torsion of the Uterus." Chapter VII, "Hyaline and Cystic Degeneration." Chapter VIII, "Calcification of Uterine Myomata." Chapter IX, "Suppurating Uterine Myomata." Chapter X, "Myomata Associated with Malformations of the Uterus" affords some interesting examples of this unusual association. We would suggest that this chapter would have been placed better as Chapter XIV. Chapter XI, "Angiomyoma." Chapter XII, "Lipomyoma of the Uterus." Chapter XIII, "Adenomyoma of the Uterus." Chapter XIV, "Myosarcoma of the Uterus." Ninety-three pages are given to this important subject, which is treated lucidly. Chapter XV, "Carcinoma of the Cervix Associated with Uterine Myomata." Chapter XVI, "Adenocarcinoma of the Body of the Uterus Associated with Uterine Myomata." Chapter XVII, "The Condition of the Uterine Mucosa in Cases of Myoma." Chapter XVIII, "Conditions of the Tubes and Ovaries when Uterine Myomata are Present." Chapter XIX, "Conditions Found in the Ligaments Passing to and from the Uterus in Cases of Uterine Myomata." Chapter XX, "The Bladder in Cases of Uterine Myomata." Chapter XXI, "The Ureters in Cases of Uterine Myomata." Chapter XXII, "The Rectal Findings in Cases of Uterine Myomata." Chapter XXIII, "Analysis of the Causes of Uterine Myomata Found at Autopsy in the Pathological Laboratory of the Johns Hopkins Hospital from the Opening of the Hospital in 1889 to July 1, 1906." Chapter XXIV, "The Cause of Uterine Myomata." Chapter XXV, "The Symptoms Associated with Uterine Myomata." Chapter XXVI, "Other Pathologic Conditions in Some of Our Myoma Cases." Chapter XXVII, "Differential Diagnosis." Chapter XXVIII, "The Effect of Removal of the Ovaries on Uterine Myomata." Chapter XXIX, "Abdominal Myomectomy." Chapter XXX, "Vaginal Myomectomy." Chapter XXXI, "Abdominal Hysteromyomectomy." Chapter XXXII, "Difficult Abdominal Hysterectomies." Chapter XXXIII, "Pregnancy and Uterine Myomata." Chapter XXXIV, "Complications following Abdominal Hysteromyomectomy." Chapter XXXV, "Results of Operations for Uterine Myomata."

Taken as a whole, the book is wonderfully clearly and interestingly written. It is essentially a huge case review with critical analyses. The authors have purposely left out all review of and practically all mention of the literature, stating in their preface that to do this efficiently would require the publication of a separate volume. The taking of this stand, while it renders the material more virile and interesting, has the disadvantage of not covering the subject absolutely. The authors, themselves, note that they have not done this in the chapter on myoma and pregnancy.

There are remarkably few typographical mistakes in the work; I notice, however, on p. 528, l. 10, that the word, puerperium, is used where pregnancy is meant; and in numerous places instead of the word, museauforceps, the word, mesoforceps, is employed. Likewise in the chapter headings the singular is sometimes employed and sometimes the pleural; in Chapter III, "Cervical Myomata," and in Chapter IV, "Submucous Myomata," while in Chapter XI we have "Angiomyoma" and in Chapter XIII, "Adenomyoma." It would seem that it would be clearer either to use the singular or the pleural uniformly. In the indexing of the book there are also certain awkwardnesses. For example, the reviewer wished to find out what the authors had to say regarding the possibility of conception in myomatous patients. He could find no reference under either pregnancy or conception but found that the matter was treated in the book on p. 475 and was indexed under "Fertility of Women who Develop Uterine Myomata."

The index likewise does not point to the page which shows what the authors have to advise regarding treatment of myoma in pregnancy. The general plan of the book is logical and excellent; we believe, however, that the chapter on adenomyoma is too brief. This important subject has been treated in three pages, a fact due to the recent publication by one of the authors of a large monograph on Adeno-Myomata. We feel that at least twenty pages should have been given to this subject in order to properly balance the book.

In the chapter on parasitic myomata the question of ascites is dealt with in a novel way; and in reading through the chapter on symptoms and diagnosis one gets quite new ideas regarding the occurrence and cause of hemorrhage in these cases. Especially commendable and original is the chapter on myosarcoma, which brings this subject into a light never before thrown upon it. This review, already too long, cannot go into further detail, but the reviewer recommends the work heartily to those interested in the subject.

The faults of the book are few compared to its virtues. It is a work which should appeal to several classes of readers. In the first place, it is easily the best laboratory guide to the normal and pathological conditions of myomatous uteri that has ever been published and should be owned by every worker in this field. In the second place, it gives in clear and candid fashion a great surgical experience which cannot but be of great interest and technical value to gynecologists and surgeons dealing with uterine conditions. And finally, the style is so attractive that the general practitioner can profit by the perusal almost as much as the specialist. The authors deserve and will receive great credit for the energy, originality and patience displayed in producing this work.

Sprains and Allied Injuries of Joints. By R. H. ANGLIN WHITELOCK, M. D., F. R. C. S., etc. (*London: Henry Frowde and Hodder & Stoughton, 1909.*) *Oxford Medical Publications.*

Dr. Whitelock's book on Sprains and the Allied Injuries of Joints, published by the Oxford University Press, is to be highly commended to the profession as a most useful work, supplying a very definite need. It is concise, clearly written and well illustrated. While its apparent brevity makes it more attractive to read, it contains sufficient detail on certain important points to make it a most valuable hand book to the general practitioner.

The author denounces with the force begotten of his great experience the treatment of every joint injury by the "rule of thumb methods" of indiscriminate massage or stupid incarceration in plaster, without first taking every means of finding out whether the injury is a simple sprain or one complicated by fracture. The one way of putting the diagnosis beyond a doubt, which may have such a serious effect on the outcome of the case, he declares, is resort to the "X-ray."

The two principal lines of treatment used in joint therapeutics, massage and passive movements on the one hand, and prolonged immobilization on the other, are discussed to great advantage with their uses and abuses. The bone-setter who treats every thing by rubbing and passive motion, will no doubt correspond more or less closely to our osteopath; while the more conservative, and perhaps more conscientious regular practitioner who treats everything about a joint with splints and plaster, also finds his analogue on this side of the ocean.

Dr. Whitelock shows where they are both wrong and that one may do as much harm as the other, if the treatment does not happen to fit the individual case.

Under no conditions is prolonged immobilization recommended, and the author lays emphasis on the muscular atrophy and the formation of fibrous adhesions within the joint which result from such treatment. Even when a sprain is complicated by fracture, he points out that early voluntary movements should be encouraged, as the nutrition of the joint and the muscles acting on it, is improved more by direct nervous stimulation than even by passive movements and massage.

Chapters 5 and 6 devoted entirely to the knee joint, are particularly interesting and instructive, being compiled from the study of a long series of cases subjected to careful observation. The poor results obtained by those who use the expectant treatment of immobilization are clearly pointed out. The author's method of treating the joint subsequent to arthrotomy, by drainage for 24 hours, is of such evident advantage in his hands, for the relief of fever and discomfort, that it is difficult to understand how any surgeon could fail to approve of it. Yet many surgeons of skill and reputation do not drain the healthy knee joint after operation.

On page 225 of the appendix, Fig. 63 represents an ankle strapped by the author's method. From the illustration it would appear that the adhesive plaster was carried entirely over the dorsum of the foot and around the ankle. The reviewer believes that it is difficult to strap an ankle in this way tight enough to give useful support, without producing a troublesome strangulation of the return flow of blood in the toes and anterior extremity of the foot. A narrow space left between the ends of the strapping, down the front of the ankle and foot, is all that is required to prevent this.

The book taken as a whole, while making no claim of adding materially to the sum total of knowledge on the subject, correlates, and puts in an attractive form, many important facts regarding joint injuries and their treatment, with some useful hints taken from the author's personal experience. J. S. D.

Operative Surgery for Students and Practitioners. By JOHN J. MCGRATH, M. D., etc. Third Revised Edition. Illustrated. Price, $5. (*Philadelphia: F. A. Davis Company, 1909.*)

As the author states in his preface this edition differs from the two preceding largely in the section on abdominal surgery which "has been entirely rewritten." Those who have followed Dr. McGrath in his work at the New York Post-Graduate School will benefit by having an opportunity to learn what he considers the best abdominal technique, and others who read his surgery will find it a helpful book.

Duodenal Ulcer. By B. G. A. MOYNIHAN, M. S. (Lond.), F. R. C. S., Leeds. Illustrated. Price, $4.00. (*Philadelphia and London: W. B. Saunders Company, 1910.*)

The author says the older writers described under the so-called "neuroses" and the term "dyspepsia" a great group of conditions which they believed to be chiefly functional, but which we now know to be due to organic diseases affecting not only the stomach but also the duodenum, gall-bladder or the appendix. He believes that among all these forms of organic disease, duodenal ulcer stands out clearest.

He says further, "we are now familiar with its symptoms, we have learnt of its dangers, and we are well-equipped with the means of treating it with permanently satisfactory results."

The work is based on the experience of the writer in the treatment of a large number of cases of duodenal ulcer, and he has, in addition, included the case reports of all published cases of Uræmic Ulcer of the Duodenum; Tuberculous Ulcer of the Duodenum, and Melæna Neonatorum and Duodenal Ulcer.

There are ten chapters as follows: History; Ulceration of the Duodenum in Cases of Burns or Scalds; Uræmic Ulcer of the Duodenum; Melæna Neonatorum and Duodenal Ulcer; Chronic Duodenal Ulcer, Symptoms and Diagnosis; Differential Diagnosis; Treatment of Chronic Duodenal Ulcer; Perforation; Pathology of Chronic Duodenal Ulcer; Appendix. Index of Authors; Index.

The appendix contains the details of all the cases operated on

by Mr. Moynihan to the end of 1908, and is written by Harold Collinson.

The illustrations are good, the book is well written and nicely gotten up.

The opinion of so eminent an authority, on a subject so familiar to him, makes the volume of great value. However, it is not always as easy to make a definite diagnosis of duodenal ulcer as the text might lead one to suppose. J. S. D.

Founders' Week Memorial Volume. Containing an Account of the Two Hundred and Twenty-fifth Anniversary of the Founding of the City of Philadelphia, and Histories of its Principal Scientific Institutions, Medical Colleges, Hospitals, etc. Edited by FREDERICK P. HENRY, A. M., M. D. (*Philadelphia: Published by the City of Philadelphia, 1909.*)

This is an important and interesting volume, as it contains much information which could not be secured elsewhere or only with great difficulty and in scattered reports. As stated in the introduction it is not a complete history of all the scientific institutions of the city, but those represented are rather general than special. The histories of six are given: The American Philosophical Society; The College of Physicians of Philadelphia; The Academy of Natural Sciences of Philadelphia; The Franklin Institute; The Wagner Free Institute of Science of Philadelphia; and The Philadelphia Museums. Under the heading of Medical, Pharmaceutical, and Dental Colleges, the histories of nine are given. The Hospitals and Allied Institutions under Municipal Management are well described, and to this chapter Dr. A. C. Abbott has added an excellent paper on The Development of Public Health Work in Philadelphia. Twenty-six General Hospitals and Dispensaries; eighteen Special Hospitals and Dispensaries; and seven Asylums, Homes, and Training Schools, have had their histories carefully written. The volume closes with two chapters on Medical Societies and Medical Journals of Philadelphia. The work as a description of the medical life of the city is one of very great interest historically, and the editor is to be congratulated on the success of his undertaking, and the city authorities on their liberality in publishing it, a most worthy memorial of a city long famed for its medical work. It is abundantly illustrated and many of the pictures are rare and add largely to the value of the volume. As William Penn was practically the founder of the city it is to be regretted that his portrait is lacking.

BOOKS RECEIVED.

Operative Surgery. By John J. McGrath, M. D. Third revised edition. With 276 illustrations, including many full-page plates in color and half-tone. 1909. 8vo. 653 pages. F. A. Davis Company, Philadelphia.

Diseases of Infancy and Childhood. Their Dietetic, Hygienic and Medical Treatment. By Louis Fischer, M. D. Third edition. With three hundred and three illustrations, several in colors, and twenty-nine full-page half-tone and color plates. 1910. 8vo. 980 pages. F. A. Davis Company, Philadelphia.

A Manual of Operative Surgery. By Sir Frederick Treves, Bart. G. C. V. O., C. B., LL. D., F. R. C. S. and Jonathan Hutchinson, F. R. C. S. Third edition. With sixteen new colored plates and many new illustrations in the text Volume II. 1910. 8vo. 821 pages. Lea & Febiger, Philadelphia and New York.

Diseases of the Heart and Aorta. By Arthur Douglas Hirschfelder, M. D. With an Introductory Note by Lewellys F. Barker, M. D., LL. D. 329 Illustrations by the Author. [1910.] 8vo. 632 pages. J. B. Lippincott Company, Philadelphia and London.

Précis du Traitement des Fractures par le Massage et la Mobilisation. Par Dr. Just Lucas-Championnière. 1910. 12mo. 267 pages. G. Steinheil, Paris.

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